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THE METAL INDUSTRY

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ELECTRO-PLATERS REVIEW

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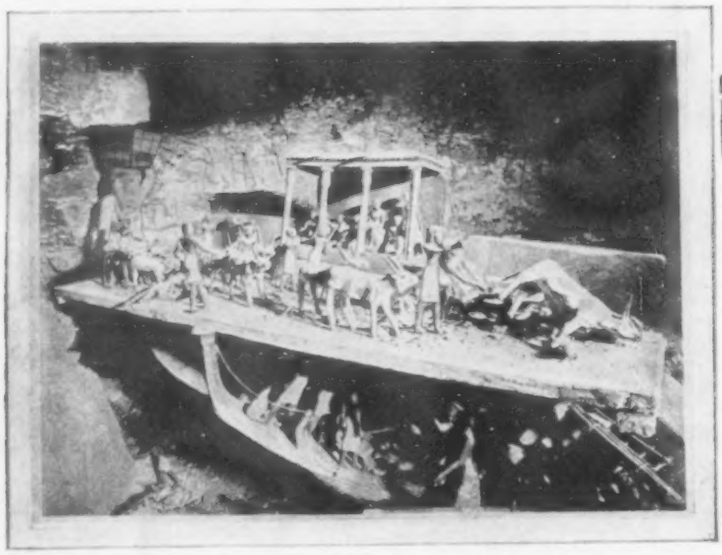
Contents Page 115

Lacquering — *an art that was never lost*



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THE
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ELECTRO-PLATERS REVIEW

VOL. 22 NEW YORK, MARCH, 1924 No 3

Annual Meeting of the Institute of Metals Division

A Report of the Sessions Held in New York, February 18-20, 1924

The first meeting of the Metals Division was held on Monday, February 18, together with all other Divisions of the American Institute of Mining and Metallurgical Engineers, in the Auditorium, with President E. P. Mathewson presiding. The occasion for this general meeting was the annual lecture of the Institute of Metals Division delivered this year by Dr. Zay Jeffries, Cleveland, Ohio, on the Trend in the Science of Metals. Dr. Jeffries compared the growth of the iron and steel industry with that of metals showing that, although copper and tin were the earliest worked metals, iron which became commercial much later has risen to a point where its tonnage is now about twenty times that of all the non-ferrous metals combined. The value of iron produced in a year is about the same as that of all non-ferrous metals combined. It seems, however, that within the last 30 years, the non-ferrous metals have shown a marked growth, increasing in production at a greater rate than iron and steel. Special examples of this fact are copper, nickel and aluminum.

The relative importance of various metals is dependent upon three things.

1. Cost of production.
2. Knowledge of properties and shapes desired for industrial uses.
3. State of the science of the metal, that is, the knowledge of the properties, its alloys and processes of fabrication.

From the standpoint of utility, it is probable that plasticity and hardness are the most important properties of metals. Certain uses, of course, demand other properties, such as electrical conductivity, but either plasticity or hardness or both are indispensable. The increase in investigations, the added energy and expenditure being put into the study of metallic alloys is such as to make it more and more difficult for the layman to make important advances in the science of metals. The trend is now in the direction of atomic physics. New tools are being used which have enabled investigators to make much more intricate studies than could have been made 20 years ago.

Dr. Jeffries discussed diffusion in the solid state giving as examples carbon into iron, copper and nickel, gold from a lead-gold alloy into pure lead, thorium and tungsten, aluminum copper and magnesium, and the complex alloys in high speed steel.

On Monday, February 18, at 6:30, at the Engineers' Club, the Institute of Metals Division met at a dinner and discussed the general situation of the Division. It was the consensus of opinion, seemingly almost unanimous, that the connection between the Institute of Metals and the American Institute of Metallurgical Engineers should be strengthened. A number of speakers seemed to feel that over-specialization in the work of societies should not be encouraged, but that all divisions or societies which had even minor points in common should co-operate to the utmost, even to the point of affiliation, rather than separate because of seeming differences in interests.

Mr. Corse, Secreary-Treasurer of the Division reported that there were about 900 members on the roster and that the Division finances were in good condition. The success of the Annual Lecture was so great that this feature was now a fixed institution. In 1925 Dr. Benedicks of Stockholm, Sweden, would deliver the Annual Lecture.

New officers and members of the Executive Committee of the Institute are as follows:

CHAIRMAN—**G. K. Elliott,** Lunkenheimer Company, Cincinnati, Ohio.

VICE-CHAIRMAN—**George C. Stone,** New Jersey Zinc Company, New York.

SECRETARY-TREASURER—**W. M. Corse,** National Research Council, Washington, D. C.

MEMBERS OF THE EXECUTIVE COMMITTEE: William Campbell, D. K. Crampton, S. L. Hoyt, A. E. White, W. A. Cowan, H. C. Jennison, H. W. Gillett, G. F. Comstock, Zay Jeffries, S. Skowronski.

FEBRUARY 19TH SESSION

The next session of the Division was held February 19, at 2 P. M., with W. B. Price presiding. The papers abstracted below were read and discussed.

SOME LOW COPPER-NICKEL SILVERS

BY WM. B. PRICE,[1] Ph.B., and C. B. GRANT,[2] M. S., Waterbury, Conn.

The work of Leon Guillet concerning the effect of nickel on the structural properties of brass is checked. The best value for the coefficient of equivalence, that is the amount of zinc replaced by 1 per cent of nickel, is shown to be—1.1 per cent. The best hot and cold-working nickel-silvers, varying in nickel content between the limits of 4 and 18 per cent, are tabulated and plotted diagrammatically. Also, some data are given showing a comparison between the physical properties of a hot-and

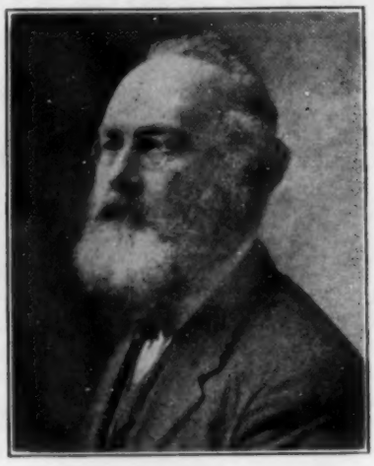
[1]Chief chemist and metallurgist, Scovill Manufacturing Company.
[2]Metallurgist, Scovill Manufacturing Company.

cold-working low copper-nickel silver, and a commercial cold-working nickel silver containing approximately 8 per cent more copper.

Low copper-nickel silver can be made ranging in color from a pale gold to a yellow white to a silver white, depending on the amount of copper and nickel present.

Alloys can be produced having good hot- and cold-working properties, but these alloys lie within a very narrow range and great care must be taken to keep the composition within this specified zone. (One such composition is Copper, 55.85; Lead, less than .1; Iron, .094; Nickel, 7.36; Manganese, none; Zinc, remained.) The color of these alloys compares favorably with the color of the standard cold-working nickel silvers now on the market. Some of these alloys also have the added advantage of greater ductility and tensile strength.

G. K. ELLIOTT,
Chairman, Institute of Metals Division



GEORGE C. STONE,
Vice-Chairman, Institute of Metals Division

W. M. CORSE,
Secretary-Treasurer, Institute of Metals Division

CORROSION OF BRASS AS AFFECTED BY GRAIN SIZE

By Robert J. Anderson[3], Met. E., Pittsburgh, Pa., and George M. Enos[4], Met. E., Cincinnati, Ohio

The following conclusions are drawn as a result of this investigation:

1. The effect of grain size on the corrosion loss of Admiralty metal (70:20:1 copper-zinc-tin) in the six solutions tested is very small and probably can be ignored in practice. This refers to grain size within the limits 0.01 to 0.10 mm. diameter.
2. In general, brass with smaller grain size corrodes less than that with larger grain size.
3. The microstructural aspects of the material corroded in similar solutions (i.e., acid, basic and neutral) are similar.
4. Intergranular cracking is caused by the action of the various corroding media.

DISCUSSION

H. S. Rawdon asked if a total submersion test would not have been more accurate due to the fact that the area of corrosion could have been more easily measured. He also stated that in his opinion water-line corrosion which is known to be greater than corrosion under the surface might have been considered in this paper.

R. J. Anderson answered that the criticism was good and these points might well have been taken into consideration, but so far as the results were concerned, at least, as regards the effect of grain size on corrosion, there would have been no different results obtained.

W. R. Webster asked if it were not possible that the conclusions reached about the effect of grain size on corrosion were not stated in a little too broad a manner. He felt that the scope of the experiment was not sufficient to justify a generality but rather only a statement that the results as obtained were true in this particular instance. Mr. Anderson admitted the justice of this condition, particularly about the point that brass with smaller grain size corroded less than with larger grain size. He stated moreover, that in his opinion grain size had little effect on corrosion.

F. B. Coyle asked if the lengths of time of the tests had been standardized. Was there any correlation between the time involved in these tests and the conditions of actual service? Mr. Anderson answered that there was not. He stated also in answer to another question that the grain sizes in the specimens worked upon in this experiment were of the sizes named in the specifications in the American Society for Testing Materials, and included a few below and above these limits.

[3]Metallurgist, Bureau of Mines, Experiment Station.
[4]Instructor in metallurgy, University of Cincinnati.

EFFECT OF SEVERE COLD WORKING ON SCRATCH AND BRINELL HARDNESS

By Henry S. Rawdon[5] and Willard H. Mutchler[6], Washington, D. C.

SUMMARY

1. The hardness changes that occur in metals as they are progressively cold rolled were measured by means of the small Brinell testing set and by the scratch-hardness method.
2. During the initial stages of rolling, the metal hardens rapidly. A maximum in hardness is reached, however, at a relatively low-deformation ratio (initial thickness to final thickness) and a reversal occurs, the metal becoming softer as the deformation is continued. In most cases, the severely cold-rolled sheet was softer than the metal in its initial condition.
3. All the metals used gave the same general form of hardness-deformation curve.
4. Annealing the cold-rolled strips at a low temperature (100° C.) softened all of them appreciably. The general form of the hardness-deformation curve was still maintained, however.
5. All the cold-rolled strips of any series, after full annealing, gave the same scratch hardness, thus showing that the test results were independent of the thinness of the strips.

[5]Physicist, Bureau of Standards.
[6]Laboratory assistant, Bureau of Standards.

DISCUSSION

A written discussion was received from **W. H. Bassett** stating that the results obtained in this paper were at variance with common experience in practical rolling mill operations. No reversal of hardness was to be found. A slide was shown illustrating this fact which differed, of courses from the slides shown by Mr. Rawdon, in that the metal showed a steady increase in hardness. Mr. Bassett stated that metal had probably become heated in the rolling and that insufficient time (if any) had been allowed for it to cool. This should result in self-annealing which would undoubtedly cause the softening mentioned by the authors of this paper. It was also noted that the metal was somewhat hard to begin with.

J. R. Freeman, Jr., stated that a number of tests had been performed of a similar character on open hearth steel and electrolytic iron which confirmed the results of Messrs. Rawdon and Mutchler. These experiments were not yet completed but he showed preliminary charts, similar in character to those developed by the authors.

W. B. Price stated that the difference of opinion was due to the difference between the way material was rolled at the Bureau of Standards and in practical rolling mill operations. In practice, the metals are water-cooled because it has been found without this the metal is self-annealed and softens markedly.

W. R. Webster asked if the metal had been rolled dry or oiled. Mr. Freeman answered that in his experiments the metal had been lubricated thoroughly.

Dr. Jeffries, when called upon for comment, said that in experiments of this sort it was probable that the most important point to be watched was the method of testing, and the correlation of these tests. Tensile strength tests on very thin material were always delicate and difficult to carry on. If a high tensile strength was obtained with low elongation it might very probably be due to ruptures at internal fissures or slip planes. If on the other hand a higher tensile strength was obtained with a higher elongation, the increased ductility pointed to the fact that the metal had become self-annealed.

Two additional papers were read, Relation of Heat Treatment to the Microstructure of 60-40 Brass by R. S. Williams and V. O. Homerberg, and Relation of Heat Treatment, Mechanical Properties and Microstructure of 60-40 Brass. These papers will be published, in abstract, in a later issue of THE METAL INDUSTRY.

ROUND TABLE DISCUSSION ON FLUXES AND DEOXIDIZERS

The round table discussion on Fluxes and Deoxidizers had been arranged in order to get some opinions which could be used by the new Committee on Fluxes and Deoxidizers of the American Society for Testing Materials, of which P. E. McKinney is chairman.

The meeting opened with expressions of opinion from a number of flux users. One after another they stood up and said in very simple and blunt phrases that fluxes and flux arguments were bunk. Nobody had a good word to say, either for the products or their makers.

After a short lull in the discussion in which it seemed that it was going to end up in general agreement and the complete rout of the flux manufacturers, one member present gave his opinion that the discussion so far had been utterly valueless. He stated that he had come for information and that all those that had spoken previously had studiously avoided saying anything. He was interested in knowing, first of all, if any fluxes were of any use at all, and in the second place if so, just where, when and how they should be used. He wanted definite, concrete facts. This started a new line of attack. Gradually members present began to give their opinions as to what fluxes should be used under varying conditions and although the statements were interesting, they were not startlingly original or new. It seemed to be generally agreed that magnesium and sometimes manganese were valuable in high nickel mixtures; that phosphorus was a good deoxidizer for copper and tin alloys; that manganese was a valuable constituent both as a flux and as a metallic part of the brasses. Borax, common salt, glass and charcoal were recommended as covers, although borax has, in addition a solvent power on oxides. Zinc chloride is useful for aluminum and aluminum is useful for zinc. Aluminum is also useful for brasses, unless these brasses have to be used in high pressure work, in which case aluminum ruins the metal, making it porous. Sal ammoniac was also recommended as a scavenger for impurities. Boron was discussed very widely and hotly, but no one could give any definite examples of the actual existence of boron in deoxidizers or of its utility.

It seemed to be the general sense of the meeting that oxidation which had previously been considered the most important cause of melting and casting difficulties was not the main trouble. Most of the members present seemed to feel that it was not oxidation but gas which caused their difficulties. Whether this gas was hydrogen, nitrogen, carbon monoxide or some other was not known, but it was strongly pointed out that advancement along the lines of the prevention of gas inclusion and occlusion would be more profitable than the treatment of oxides.

Later on in the meeting, the flux manufacturers had their chance. One representative stated that his firm sold alloys on the basis of price, quality and analysis. This was recognized by all present as obviously a very fair method of dealing and no quarrel could be picked with this practice. Other firms were represented and spoke up, one or two quite frankly, saying that they saw no point in divulging the compositions of their mixtures, since in many cases it might only prejudice a user against them, and could do no good. Some stated that they were willing to give their analyses when asked, but had found it to their disadvantage to offer it. Others stated quite frankly that they had no intention of giving their analyses but staked their reputations on results.

A good start was made, but that was all. The situation in the future so far as the use of fluxes, deoxidizers and de-gasifiers is concerned unbelievably muddled and an enormous amount of patient work is necessary with the co-operation of everybody concerned before things can be straightened out. Unquestionably, the practice of selling a mixture of cheap ingredients under a fancy name, and at an exorbitant price is inexcusable, even though that mixture is helpful. Nevertheless, it is a known fact that concerns doing just that sort of thing are growing steadily and are selling large quantities of their materials to large users. It would seem to an unprejudiced observer that the blame should rest not only upon these manufacturers but also upon those who purchase from them. The small foundryman who does not know what goes on in the crucible, who works only by rule-of-thumb can be excused for buying these materials, when they help him out of his difficulty. But when a large organization, working under technical control, orders fluxes in ton lots without knowing their composition, they should share the blame with the manufacturer of these patent medicines. There is a sure cure for quack dopes and slight-of-hand cure-alls. Refuse to buy such materials. They will very quickly disappear.

Storing Crucibles

A Discussion of the Theoretical and Practical Aspects of Crucible Storage Methods

Written for The Metal Industry by JONATHAN BARTLEY, Graphite Expert

Q.—We use crucibles for melting brass and are interested in a convenient and satisfactory storage for them. We should be able to get this from the crucible manufacturers but in case you have any definite information showing the best practice in the storing and taking care of crucibles we would be very glad to have it.

A.*—Every foundry, whether large or small, should have storage ovens for crucibles, built regardless of expense, but suitable as to size and conditions. Sometime ago we visited a plant where they did not use more than 12 casks of crucibles a year, ordering in lots of two casks at a time. They had an oven built of brick about 8 by 10 feet and 8 feet high. On the bottom of the oven they had several coils of steam pipes overlaid with perforated steel plates on which the crucibles were stacked bottom-side up. Exhaust steam from the engine was used to supply the heat.

The method of ventilation was by various holes on the sides and ends of the oven below the center because roof ventilation will not answer in a drying oven of this kind, inasmuch as the tendency is to allow the heat to escape while the damp air fails to pass off at the bottom. If it is impossible to use steam, this same oven can be used with direct heat. In some cases it may be possible to utilize the wasted heat from the furnace itself as it passes on its way to the stack. In place of the coil or steam pipes a large flue could be made to pass underneath the bottom of the oven covered with tile, and the heat passing through this flue would radiate sufficiently to dry the crucibles very easily. When constructing a new plant an oven of this type would be advisable because it would be less expensive inasmuch as it would not cost one dollar for fuel.

There is still another plan for such an oven where neither steam nor direct heat from the furnace could be applied, and that would be to use the same type of oven, having in one end a fire-box from which could run a set of return flues back and forth underneath the bottom of the oven with a stack at either end.

We saw an oven of this type some time ago which was built for drying out clay which contained 20 per cent moisture, and we were told it required less than one-half ton of coke per week to run it.

Of course a plant that brought crucibles in car lots would require a much larger oven but that could be built on the same lines with identical results.

THE CARE THAT COUNTS

There are three strong arguments in favor of storing and drying crucibles in this manner:

1. They get a uniform, penetrating heat for a long time which has a tendency to harden the clay and seems for some reason or other to add strength to it, rendering a crack very much less liable.

2. The storage oven plan will permit a crucible being taken from the oven, charged and placed direct in the furnace at an even temperature throughout—it will not be cool on one side and hot on the other causing an unequaled expansion which always results in a crack or an internal fracture which will result in pin holes.

The third very important advantage of the scheme is that it will entirely eliminate a scalp.

*From a booklet on crucible storage issued several years ago by the Jonathan Bartley Crucible Company. This booklet is now out of print.

Some foundrymen seem to think that if a crucible stands on a shelf or some place above the floor in the foundry, it is impervious to moisture. This is not true. A foundry at all times is moisture laden; necessarily so because of the steam and hot gases from the flasks or molds at the time the pour is made.

A crucible can be very favorably compared with a cigar. No doubt a great many readers of this article have noticed how cigars in a cigar case will absorb the moisture from a wet sponge, just so will a crucible absorb the moisture of a foundry unless they are kept at a temperature above 212° F., or the boiling point of water in order to dispel that moisture.

We have been surprised to learn how many foundrymen there are who do not know that their crucibles have been burned before they get them. The crucible manufacturer has to start with a mixture containing not less than 20% moisture, gradually dry the same, and put it through his kiln at a temperature little below the melting point of brass. Ordinarily from 1,200 to 1,400 crucibles are fired at one time. **If he can take the material in its raw condition and have it pass through his kiln without scalping** why should the user ever be troubled if anything like fair treatment was given?

The importance of giving attention to these suggestions cannot be overestimated, and we are sure that a furnace of this kind would pay for itself in the course of a year, as they can be built at very little expense, and we hope that we have with this article in its crude form, started a movement which will soon bring dollars to the crucible user and a smile to the crucible maker.

Q.—We thank you for your letter of the 10th enclosing instructions for crucible storage. While we have enjoyed reading it, the particular points we wished to know about seem to be missing.

In the first place, someone proposes that the crucible storage shall be kept up to the proper temperature at all times. How can this be done while running on an 8-hour shift?

Second, you state that the temperature must be kept at or above 212 degrees, but you do not explain how an entire room can be held at this temperature, when the only source of heat is exhaust steam. The steam itself may be above 212 degrees, but it will not heat the air in a room to anything like this temperature.

As we handle the situation, we use open flame gas fired furnaces on the first floor. The heat and fumes from the furnaces pass up a flue about 4 x 8 feet, through the second floor. Our pots are stored on the second floor and are stacked around this flue.

Before placing a pot in service it is placed alongside or behind the furnaces for a day or at least a half day, where it becomes somewhat hotter than 212 degrees. After several hours here it is laid on top of the furnace on its side, or placed in the furnace bottom up, and is heated slowly until it is red.

The metal is then charged and no further special attention given it, except to place it in the furnace overnight after the last heat is poured.

We would like to know if crucible makers consider that it is economy for us to maintain crucible storage in which the temperature is to be kept at 212 or above continuously?

A.—I have noted very carefully the points that your in-

quirer takes exception to, and he is right. If every user of crucibles were as observing and careful to get at the bottom of things as he is the word CAUTION is all that would be necessary to paste on a crucible. But the facts are the majority of foundrymen have to get their medicine rationed out in "horse dose" before it has any effect. In other words the crucible doctor is a whole lot like a medical doctor. The majority of his patients are so thick, stubborn or careless that he has to overstep the bounds of common reasoning to prevent an epidemic.

Although I have advocated the very things that he questions I know that it is not necessary that crucibles should be kept in a temperature that was constant, or that 212 degrees represented anything but a factor of safety applied to the crucible at the time it is used. I have taken crucibles as large as size No. 400 from a cold dry storage that carried 4% moisture and thoroughly annealed them inside of five hours, but it required the most careful attention to do this. It would be thoroughly impracticable to advise such treatment because in nine cases out of ten the remedy would increase the disease, so the crucible maker attempts to frighten his patient by advocating "extreme unction."

A room heated with exhaust steam for 8 hours every day would be a very safe storage for crucibles, but before being placed in the furnace they should be placed on top of the furnace **bottom up** and occasionally turned around so that they are heated evenly throughout. As far as your inquirer's method of annealing is concerned I would consider it as good as a special room, and if he is troubled with "scalps" I'd like to know it.

Thirty years ago 75% of the crucible maker's troubles came from "scalped" pots. Even the largest rolling mills had not been educated to knowing that the fault belonged to themselves, and it rested upon the crucible maker to show them that it did. With this end in view the Dixon Crucible Company started the ball rolling. Article after article was written on the subject of "Proper Annealing" and the result is that "scalp" complaints are very rare.

"Proper Annealing" can be accomplished in many ways or methods, and these have to adapt themselves to conditions. In the inquirer's case I do not see where anything can be gained in building a special room. According to his letter he has met all the requirements, and I cannot see how his method could injure a crucible through too hasty expulsion of moisture. **Slow** annealing is absolutely essential. To do it within five hours as I have mentioned means that it must be constantly handled so that all sides get heated evenly at the same time.

Opinions vary on what is called "aging" crucibles. Some believe that a crucible is like whiskey; the older it is the better it gets. But I only believe in this theory as it refers to the crucible **before** it is burned. I do know as a positive fact that "aging" in a green or unburnt crucible brings about a chemical change that improves the quality, but after the crucible has been burnt and the life (clay) calcined I do not believe that anything is gained through aging.

Loose Pulley Troubles

Q.—I have considerable trouble with a loose pulley on a small machine. The pulley keeps binding on the shaft and finally gets heated up so that it binds sufficiently to make the whole machine move. It will run quite freely for a short time after being taken off and oiled, but the trouble soon starts again. Can you suggest a remedy?

A.—There may be several causes for the heating of a loose pulley on the shaft. A common cause of trouble is dirt getting into the bearing between the pulley and the shaft causing some cutting and making a rough surface. When such a condition once starts it is almost impossible to keep the pulley from heating. The remedy is to smooth the shaft or replace with new one. Belts that are too tight often cause heating of the loose pulley especially if the speed is high. The pressure may be sufficient to break through the film of lubrication, and once a slight heating has started the oil becomes thin and runs off leaving the bearing practically dry when heating is bound to result.

As a remedy for your troubles the following suggestions are offered. Remove the pulley and make sure that the shaft and bore of the pulley are smooth and clean. If the belt is too tight add a short piece and run the belt as loose as possible to handle the work satisfactorily. Fit a grease cup to the pulley and use a good grade of grease.

If none of these methods is successful in preventing heating of the pulley then some special form of bearing will have to be used in the pulley, such as ball or roller bearing.—P. W. Blair.

Monel Metal Golf Heads

Q.—Can you furnish us information about the manufacture of Monel metal golf heads? We have a sample head finished complete and do not know if it has been manufactured from a casting or a forging. We have cast a few and finished them complete and found the cost to finish very high. The surface of the castings were rough; also the machining of the taper hole in the end where shaft fits was the expensive part.

A.—The Monel metal golf heads now on the market are made of cast Monel and the taper part on end where the shaft fits is cored and reamed with high speed steel reamer which will reduce your cost considerably. By using the correct grinding wheel for roughing off the surface on the castings, you will reduce your polishing costs.

Monel metal forging practice follows closely that of steel. It is harder under the hammer than mild steel, approaching more closely the well known nickel steels in behavior, except that the oxide scale adheres strongly to the metal and refuses to free itself even under hammer blows. The hand forging method is not practical, using a blacksmith's forge unless it is protected in some manner, as for example by inserting it in a pipe or shield. Forging temperatures range from 1,200 F. to 1,900 F.

Forging hammers and drop hammers are suitable for working Monel but forging presses are not. Drop forging dies are usually made from .80 carbon steel hardened to give a 60 hardness on the scleroscope. The die design should be such as to prevent too rapid chilling of the part where the deformation occurs. The successful forging of Monel metal is largely dependent upon proper heating. —P. W. Blair.

Blanking Punches and Dies for Aluminum

Q.—We are having trouble in punching and drawing aluminum as the metal adheres in fine particles to the tools. We use a solution lubricant on the work. What is the clearance required between a blanking punch and the die?

A.—Aluminum is a soft metal and clings to the punch and die, so they should be cleaned occasionally to remove the fine particles of aluminum that adhere to the edges of the tools. They should be kept bright and polished. When the surface is smooth no difficulty in stripping of the work is likely to be met.

The use of a good lubricant has a good effect on the appearance of finished articles. For deep drawing tools a cheap grade of vaseline or lard oil is best. For blanking, stamping and shallow drawing tools a thinner lubricant such as kerosene is preferable.—P. W. Blair.

Molding Machines and Molding Practice

The Principles of Machine Molding and How to Distinguish Between Different Types for Different Classes of Work

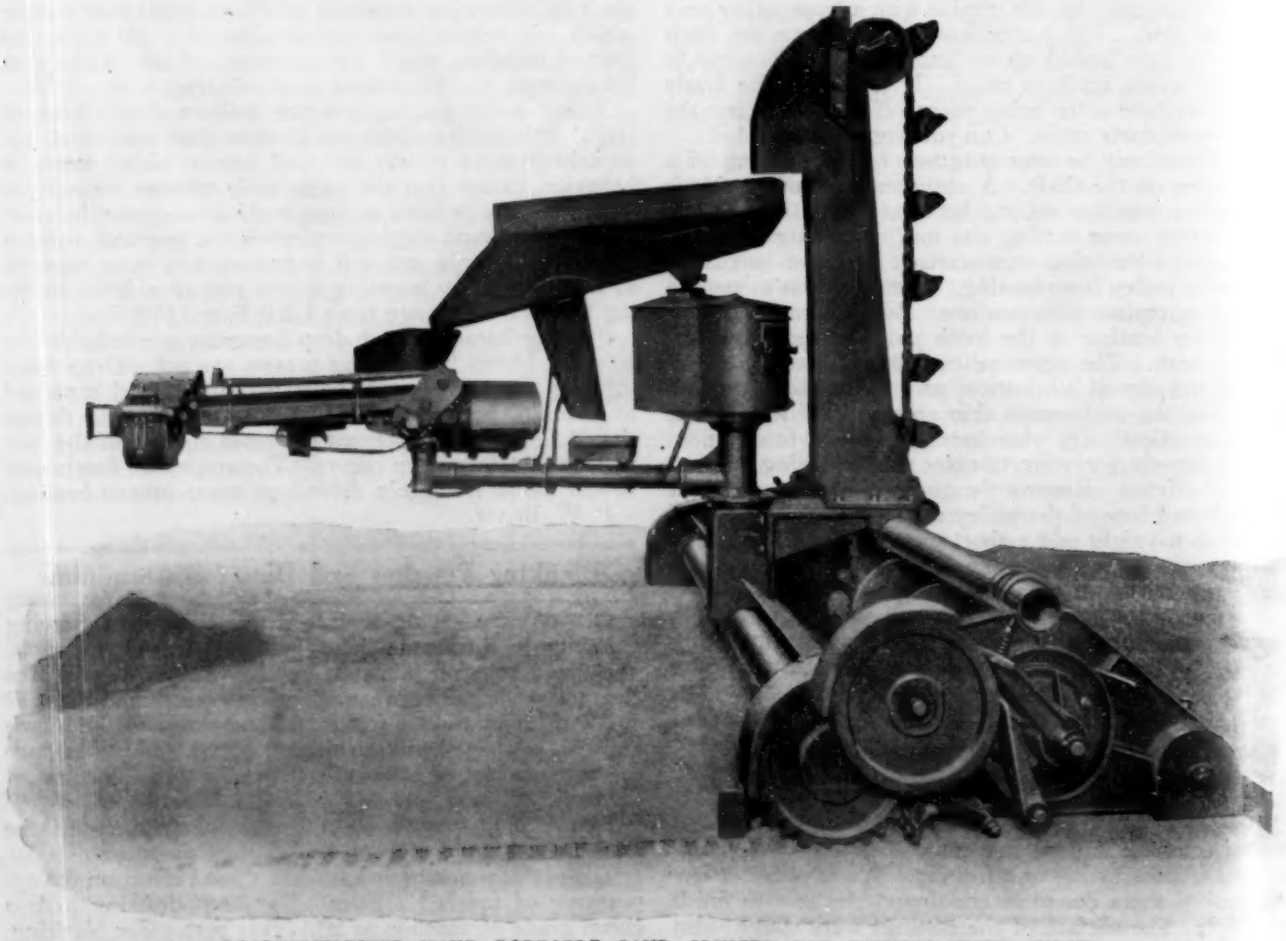
Written for the Metal Industry by R. R. CLARKE, Foundryman

A molding machine is a device to divert power to the making of a mold either in part or in full. It is simply a mechanical means of duplicating on a larger, faster and cheaper scale, the various operations of hand molding. When a machine fails in one or more of these overbalancing advantages, it forfeits consideration unless used solely to improve quality, to lighten labor or to substitute for skilled labor otherwise unavailable. These latter considerations are among the machine assets and may often justify it even against other challenging factors. Preparing and delivering sand, "shaking out" castings, transporting molds, etc., constitute the related phases of molding and a vast daily quota of hard labor. To these different tasks mechanical appliances are frequently assigned, making along with the molding machine itself what might be termed a molding machine system. In different foundries systems are quite elaborate and efficient. This article will accord them due attention later on.

MOLDING MACHINE PRINCIPLES

To an intelligent discussion of molding machine practice a brief examination of molding machine principles appears a preliminary expedient, principles resting on the different molding operations and the mechanical means of executing them. Mainly, these operations consist in ramming, rolling, parting, gating and dressing the mold plus the drawing of the pattern. Ramming is of the pien and butt variety. Machines pien ram by jolting the mold perpendicularly downward, by throwing or "slinging" the sand around and over the pattern, by dropping the sand in mass from a height, or by pressing into the mold a board so cleated as to produce the requisite sand density in the different parts of the mold. Proper piening in many classes of work is difficult to duplicate by machine and frequently represents a shortcoming overcome at times by either displacing or supplementing the machine effort with the hand operation. Butt ramming is mainly a squeezing proposition, the pressing board being either squeezed into the mold or over the mold. In the latter case the sand of the mold is usually raised to the proper level above the flask edges prior to the squeezing. In different machines and in different classes of work pien ramming answers also for butt ramming and vice versa. Examples are the "sand slinger" machine and the plain squeeze using the cleated pressing-in board.

Machines roll molds over by clamping them securely to the machine table whereon they are rammed up and swinging the whole outfit about a fixed axis through a

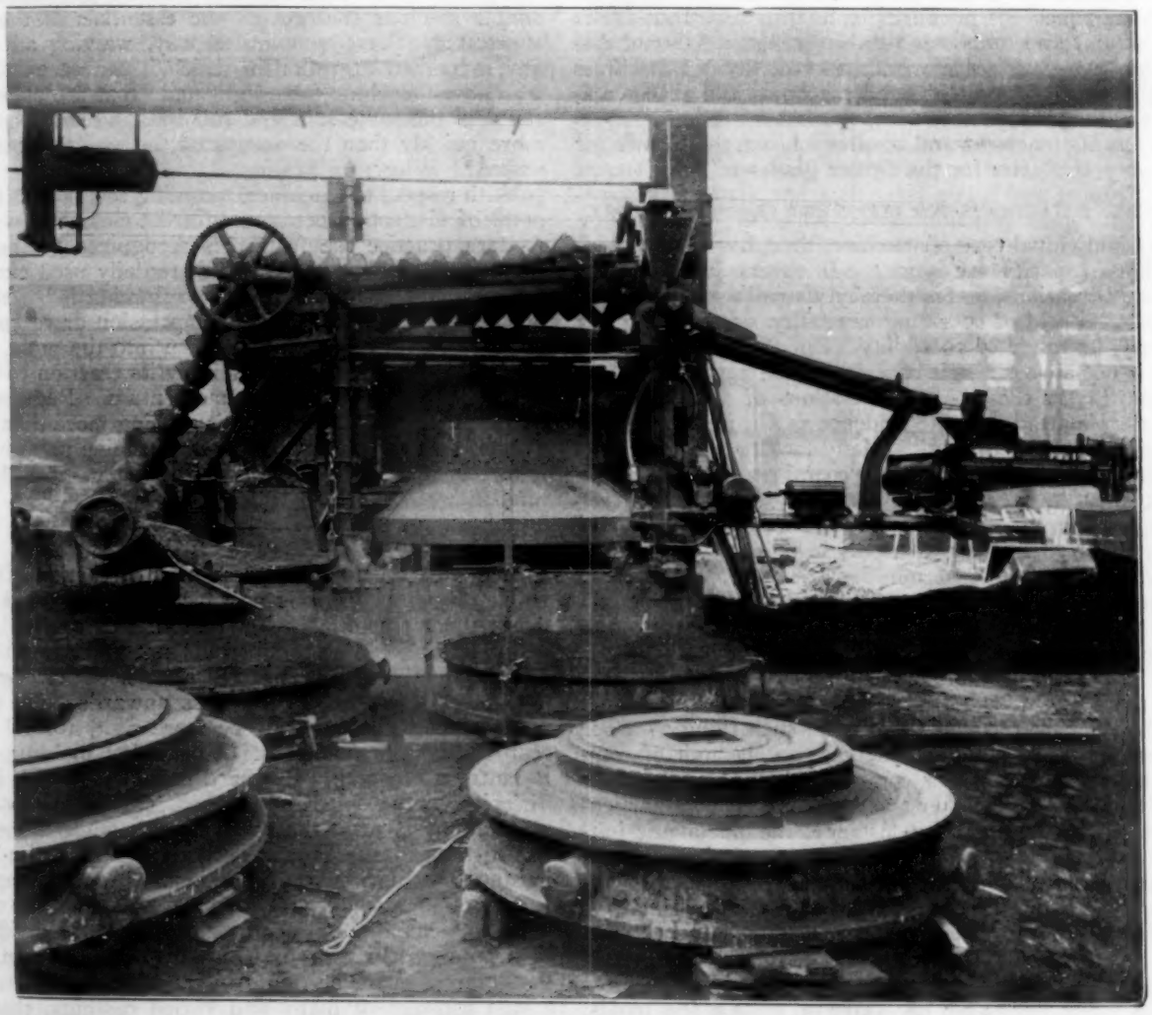


BEARDSLEY-PIPER HAND PORTABLE SAND SLINGER FOR MEDIUM SIZED WORK

semi-circle to the opposite side of the machine. Some machines swing on a long radius through a wide arc—others revolve on a shorter radius from the top to the underside of the machine. Still others raise the molds to the approximate center of gravity and rotate around it. Light molds are machine-rolled by hand, heavier ones by power, countering springs or weights or air cylinders being so attached as partially to balance the weight and facilitate the operation. An important particular in manipulating "roll-overs" is the resting position of the mold on the receiving table while drawing the pattern. It should set firmly level and at an angle of exactly 90 degrees to the perpendicular drop of the receiving table in lowering from the pattern plate on the swinging table.

Parting and gating the mold are pattern plate capacities rather than machine functions. As to dressing the mold, no machine makes any attempt to do it. It is the business of the machine and the pattern plate to produce a mold requiring neither patching nor dressing. Patterns are machine drawn by an up or down movement of the mold from the pattern plate or the pattern plate from the mold. This movement, mechanically controlled, must conform identically with the angle of the pattern to the horizontal plane of the plate, usually 90 degrees to the perpendicular. It needs also to be smooth, steady and in a straight, unbroken line. Lateral thrusts of any degree violate the fundamentals of the operation. As an aid to a clean lift the action of a vibrator usually attends the operation, the vibrator being a substitute though not exactly a duplicate of hand-rapping the pattern. Displacement of sand by vibration is very slight and uniform throughout, things not always in evidence in hand-rapping.

Stripping plates and stools are further aids in drawing patterns by machine. The former is a plate of uniform and substantial thickness neatly filling around the pattern and extending laterally beyond the flask dimensions. The pattern in leaving the mold either drops through the shipping plate or is cleared by an upward movement of the stripping plate. Strippers are used on patterns that embody drawing difficulties such as gear wheels with the teeth cast in, or deep patterns without draft. They function independently of the vibrator, compensate for pattern and machine deficiencies and are virtually infallible. "When in doubt use a stripping plate" is an excellent rule in machine molding. Stools are loose sections of the pattern that project with the drawing motion, thereby supporting sand that would otherwise break away. They answer for stripping plates either within or underneath the general bounding lines of the pattern base. By the up or down movement of the plate or the mold slight differences in results may sometimes be expected. As to their relative merits the following brief remarks are offered. When a mold moves downward from a plate or a plate upwards from a mold, gravity aids to prevent the sand breaking away from around the pattern. But when a plate moves downward or a mold moves upward gravity favors the



BEARDSLEY-PIPER LOCOMOTIVE TYPE SAND SLINGER FOR LARGER FLASKS. IT RUNS ON A TRACK BY ITS OWN MOTIVE POWER

break. A plate dropping from a mold has a motion less disturbed than a mold rising from a plate especially where there are inequalities in the joint edges of the flask.

The common practice in connection with machine molding is to draw the pattern plate by hand by attaching a vibrator to the plate and lifting the plate perpendicularly from the mold. This method is applicable to a wide range of work and is successfully used in many foundries.

DIFFERENT TYPES AND NAMES OF MACHINES

Not many machines cover the molding operations in full. Some merely ram, others simply draw, others again roll and draw, while a great many ram and draw but do not roll.

Some machines are operated by hand, some by belt drive, some by direct drive and a goodly number by compressed air. In classifying or referring to machines, the general tendency is to separate and designate them from the standpoint of the power used and the molding operations covered. By this method such common and self-explanatory terms appear in connection with molding machines as: hand-ram-pattern draw; hand squeeze; pneumatic-jolt-squeeze; pneumatic-jolt-squeeze-pattern-draw; sand slinger; pneumatic-jolt-roll-over, etc. A broad distinction, however, sometimes observed, divides machines into the simple classes of hand machines and power machines. With respect to size, machines are referred to simply as big machines and small machines, the former for the heavy, the latter for the lighter grades of work.

DIFFERENT MACHINES FOR DIFFERENT CLASSES OF WORK

Each individual type of machine, then, has its own constitutional capacity for work. It covers just so many molding operations, and is thereby virtually self-determining as to its field of operating capability, or perhaps more properly, its range of possibility. But the range of a machine is not always a safe criterion. The mere fact that a machine covers the molding operations of a certain class of work is not indisputable evidence that it is the best machine for that class of work. Many factors enter the comparison, so many indeed that a general proposition on the subject must be only guardedly stated. And yet the basic principle is simple enough, a mere matter of demand and supply trimmed to their essentials in point of time, effort and scope. The old and familiar questions, "What kind of a machine shall I buy?" or "What type of machine best suits this or that class of work?" are reduced, therefore to a simple analysis of the molding essentials in these different classes of work and those types of machines that cover these essentials to the very best advantage. For it must be remembered that there is no such thing as a one best and universal molding machine, no one unit of combined mechanism, however complete, that can outclass or even compare with all other machines in their own particular spheres. Consider, for instance, the pneumatic-jolt-squeeze pattern draw which covers a wider variety of work perhaps than any other small machine. Compare it with a plain pneumatic-squeeze for making round brass bars, 1 inch diameter x 10 inches long, five patterns on a plate. What are the molding essentials? Well, they are not always all that the molder observes. Quite a few molders do quite a few things not necessary on quite a few molds, thereby consuming time that accomplishes nothing. The real essentials to the brass bar mold are fairly hard piening around the flask edge, moderately stiff butt ramming over the patterns and a most simple pattern draw. Now the pneumatic-jolt-squeeze-pattern draw will do all that with a few bumps, a bottom board pressed on and a drop or lift of the drawing mechanism. But turn the plain pneumatic-squeeze loose on the job with cleated pressing-in boards and a rapid hand-lift of the pattern plate and you not only conserve the air consumed in jolting the mold and drawing the pattern but stage a run-away race for the squeeze in the bargain. Even a plain "hand squeeze," adeptly handled, might set the pace on that class of work while a simple hand-ramming-pattern-draw would likely hop to a fair chance for third place. The jolt-squeeze-pattern-draw simply exceeds the demands. It involves eight distinct manipulations and one time consuming pause, whereas the pneumatic-squeeze and the hand-ramming machines each need only six manipulations and the hand squeeze gets by with practically five. Now the jolt squeeze is an elastic machine, a practical machine, of wide and useful range, and can be used either as a plain squeeze or a jolt-squeeze combined with or without pattern draw. In its element it is unbeatable, but it is out of its element when exercising its full functions to make a mold where a cleated pressing board and a simple hand lift are the only essentials. But suppose these bars were to be molded on end instead of lying down. Now you're talking to the jolt squeeze. That's the element of the jolt squeeze and it sweeps the field. It cannot be too well understood that the practical machine for any class of work is the plain simple machine that covers the essentials in the easiest, shortest and least complicated way, waiving all claim to any individual operation in which it cannot excel. Why a roll-over machine for a light mold that the operator can stand in the same spot and roll by hand more easily and more quickly than the clamps of the machine can be adjusted? Why?

With respect to machines, ramming the mold is the main point of distinction between different classes of work. In modern practice the feature is recognized to the degree that a vast number of machines are daily used exclusively for ramming. Now all machine ramming is based on one of three principles: impetus, compression or reaction. In other words, sand is either thrown into the mold, pressed in or induced to settle solidly in by its reaction to the machine jolt aided by its own momentum. Reduced to its elements even hand-ramming is nothing more than a series of localizing compression, while a machine pressing board is merely an expensive hand butt rammer with force behind it.

THEORETICAL ASPECTS OF MOLDING

In effect, impetus, compression and reaction differ signally. By impetus it is possible to ram a mold of any depth to any degree within reason. Also by jolt, any depth of sand can be rammed but not uniformly throughout the depth. The sand will always be hardest where deepest and decrease in hardness upwards. In pouring position then the mold will be more rigid around the top than the bottom, which is not orthodox molding applied to patterns of depth. But hard ramming by jolt is much different to that by hand method, and makes possible a mold amply rigid at the pattern depth without menace to the casting in the sand strata further up, even though hardness be much more in evidence there. Compression is very much a surface proposition and extends to no great depth in a mold. Besides its effects are often difficult to distribute properly around and over the pattern. It is that type of machine-ramming, answering admirably for a vast tonnage of many and varied castings, that occur in the surface of the mold. In addition it is widely used to complete a mold otherwise rammed to the point of squeezing.

Summing up the situation, it might be said that impetus and reaction deliver the pien-ramming effect while compression produces chiefly the butt-ramming. The statement, however, is relative and admits the practicability of either machine for either purpose in many classes of work. Nevertheless, as a general rule, the jolt and sand-slinging

machine apply to molds where the ramming must be more firm throughout depth, while the squeezer machine functions best in castings, requiring a more nearly uniform density of sand in the surface vicinity of the mold.

To illustrate, imagine a brass collar, 8 inches outside diameter, 6 inches inside diameter, 1½ inches deep. The squeezer covers the requirements perfectly. Suppose this collar to increase in depth to 8 inches, which is beyond practicability in ordinary squeezing. The jolt, however, meets the demands and is the logical machine. Now suppose further that these pattern dimensions were to increase in all directions until the size of flask or weight of mold exceeded any reasonable size or power of jolt machine to manipulate. Here, then, is the domain (though not the exclusive field) of the impetus or sand-slinging machine, a comparatively recent development, quick of execution, reliable and simple of operation, and up to standard in accomplishment.

Casting Metals

A Variety of Melting and Molding Troubles and Their Solutions*

Written for The Metal Industry by WILLIAM J. REARDON, Foundry Editor

HIGH PRESSURE PUMP CASTING

Q.—Enclosed is a sketch of a pump casting made by pulling a pencil around the pattern on the joint, being full size and showing the core prints, etc.

As you will note, this casting is practically a Tee with a couple of additional bosses for outlets, and a bracket or foot cast on each side. You will also note, a very heavy rib in one of the angles. This is used in breaking up the fat globules in condensed milk and must stand seven to eight thousand pounds test pressure.

We have cast them flat, also on end with the end marked B in the cope, gating on one of the bottom flanges, using an alloy of 85-5-5-5. We have also used several other alloys, but this seems best. Only a very small percentage will pass the test, although quite a few will hold three or four thousand pounds pressure for several minutes. The heads go down well, and the metal looks good to the eye.

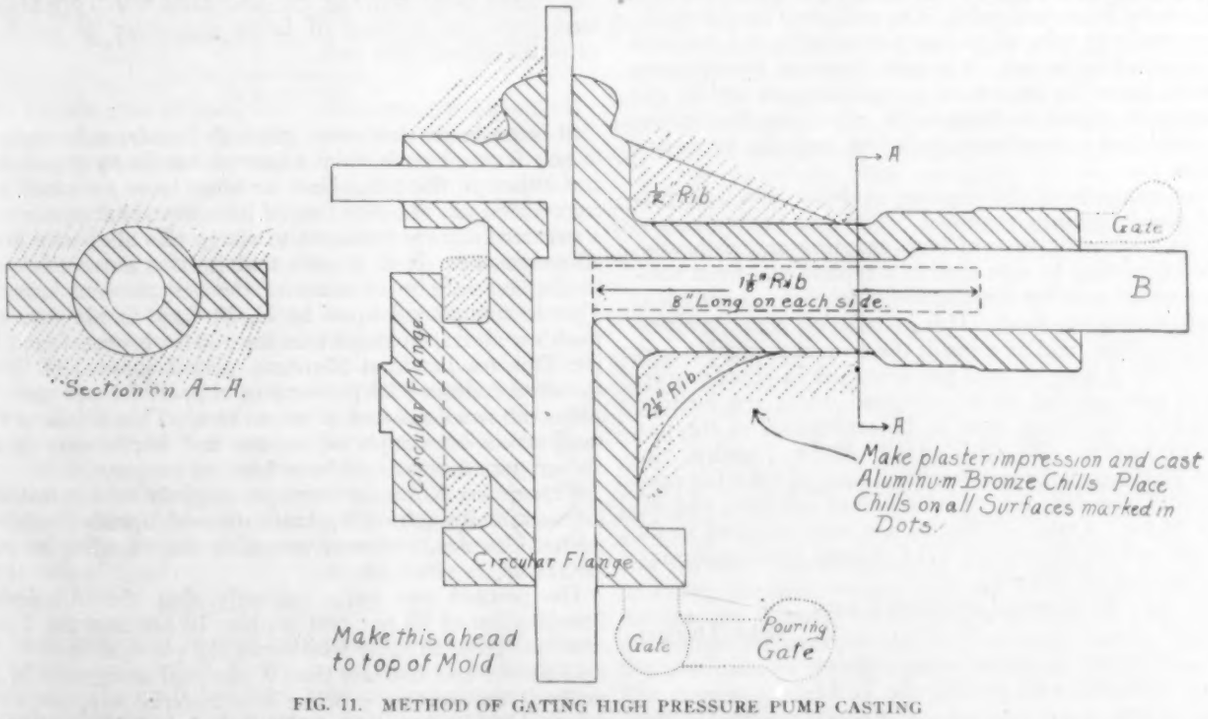


FIG. 11. METHOD OF GATING HIGH PRESSURE PUMP CASTING

What we wish to know is what is the best alloy and method of molding and gating this job to insure perfect work? We have tried high heads and hot pouring; we have melted the metal in both a Hawley Schwartz furnace and an electric induction furnace.

A.—The alloy that we would recommend for the castings consists of 84 copper, 13 tin, 1½ zinc, ½ lead and 1 of 15% phosphor copper, made and cast as follows:

Melt the copper under a cover of charcoal; get it to about 2,100° F., and add ½ lb. of the phosphor copper. Then add the tin a little at a time, stirring well after each addition of the tin; then add the zinc, stir well and add the balance of the phosphor copper. Stir well, pour into ingots and remelt, and get the metal to about 2,000 degrees. Add ½ lb. of zinc to the hundred lbs. of ingot and ¼ lb. of 30% manganese copper. This alloy when properly handled will stand a hydraulic pressure of 10,000 lbs. per square inch and will not sweat or leak, if you use the furnace properly and melt your metal free from slag. If you make slag in melting we recommend using the crucible furnace. If you use the open flame we suggest that a flux of 2 parts fluorspar and 3 parts lime be used. As for molding we recommend a dry sand mold made with a good open sand. We recommend a loam sand such as is used in dry sand work for large iron work. Ram the mold up as you would a core. Draw the pattern and place in oven to dry same as a core. Paint the mold with a good grade of black lead or bull run talc and gate and chill as per Fig. 11. Make chills out of a mixture of 90 copper and 10 aluminum. We advise the use of chills to close the grain of the metal in the heavy sections and this mixture will lie well in aluminum bronze chills. Use a little lard oil on the chills.

*Other problems in this series were published in our issues for January and February, 1924.

Some Foundry Problems

General Difficulties in Casting Metals and Alloys as Met in British Practice*

By A. H. MUNDEY
London Manager, Fry's Metal Foundry, London, England

The subject to be presented is indeed so formidable and far-reaching that it appears to be almost impossible to even attempt to handle it with any reasonable hope of solution. It is desired, however, to refer to a number of the little every day problems, in order to suggest subjects of discussion. The real opportunities of the scientific metallurgist and the practical foundryman meeting on common ground and learning something of one another's difficulties are still all too small, and it is sincerely hoped that this annual chance will not be missed.

The art of founding or casting in fluid metals and alloys, has been practiced for so many centuries that we are apt to lose sight of the wonderful pioneer work of those old metallurgists. From the time of Tubal Cain or his prototypes throughout the world the activities of the foundryman have been controlled by his facilities of melting his metal.

The furnace and the economic application of the fuel available is one of the first of the problems which confront the foundry manager.

PIT FURNACES—COAL VS. GAS

There is indeed much to be said for the old fashioned simple coke fired pot fire type. It is cheap and simple to install, easy to manage and insofar as it does its job well, is, within the limits of its capacity efficient, further, and this is a very important point, it is well liked by the workmen generally in spite of its many drawbacks and the hard labor involved in its use. It is easy, however, by reference to reports issued by makers of special furnaces and by gas companies, to obtain evidence to the effect that the furnace using solid fuel is hopelessly inefficient, and also expensive in labor.

As an example of the type of evidence which is furnished the following is quoted. The gas engineer concerned is a scientific man of high standing and authority.

It is interesting to note that in a typical coal fired non-ferrous metal melting installation, the coal consumption averaged 6 tons per week. This installation was converted to coal gas firing, and as a result the economy effected was equivalent to 4 tons of coal per week, or in other words, where 6 tons of coal were consumed under the melting pots, only 4 tons have now to be carbonized at the gas works to produce the same result at the foundry, the process yielding at the gas works, 2 tons of coke for sale, and in addition 100 lbs. of ammonium sulphate and 40 gallons of tar. Only 220 therms are now required to do the work, where previously 1914 therms were necessary by the burning of raw coal.

THUS—42 tons of metal required 6 tons of coal.....	1814 Therms
42 tons of metal now require 40,000 c.ft. of 550 B. T. U gas	220 Therms

If we assume the thermal efficiency of this particular example of a coal fired metal melting furnace was only 5% then the conversion to coal gas firing increased this figure by about 8 times, or 40% thermal efficiency.

The merits of tilting furnaces, fired with coke, gas and with oil of various grades, have all been placed before the man who needs to melt his metal, and he has further been called upon to consider and decide upon the choice between each system, in respect to his own works. There seems to be no possible arbitrary rule. The choice must be governed by circumstances. In a large works, where ample facilities and space are available, producer or Mond gas with regenerative systems may effect enormous saving, and be in every way satisfactory. On the other hand a proposal to change from town gas to producer gas in a large and well known foundry, had to be abandoned on account of the scattered units to be served and the want of space for the producer plant despite the promise of very considerable monetary savings.

The use of oil-fired tilters for melting brasses during the war period was greatly extended, but it is noted that these furnaces were among the first to be taken out of use when the slack period came.

ELECTRIC HEATING.

Electric heating is particularly attractive for certain classes of work, notably in the case of the low melting point alloys used in the printing craft. In these latter instances the heating elements are usually enclosed in sheet steel envelopes and immersed in the metal, and by this means avoid many of the difficulties which are associated with the melting of large quantities of metal in external heated iron pots.

GUN METAL

It is probable that every general foundryman engaged in non-ferrous work, thinks first of Admiralty gun-metal, and although there has been no alloy more criticised and commented on, the very fact of its universal acceptance as a standard alloy is sufficient to stamp this alloy as a good all-round one. It is notable that it is so extremely near to the composition of some of the very ancient bronzes. This is commented upon by E. F. Law in his standard work on alloys, in respect to the rod of bronze found by Dr. Flinders Petrie at Meydum, period about 3700 B.C., found to contain 89.8 per cent of copper, 9.1 per cent tin and some small amount of impurities. This is indeed the earliest known sample of bronze and implements of an earlier period appear to have been of copper.

Francis W. Rowe, in his paper recently read before the Lancashire Branch of the Institution of British Foundrymen at Burnley, reviewed very ably the founding of gun metal and its allied alloys.

He pointed out very correctly that the Admiralty Specification of 88 per cent copper, 10 per cent tin, 2 per cent zinc gave an alloy which met the physical tests of 14 tons tensile and not less than 7 per cent elongation in 2" easily if the melting practice and material supplies were reasonably good, and that he had found it possible to obtain much better results than this in a very large number of cases.

It might be well pointed out that the adoption of Admiralty gun metal is probably more religiously adhered to by general engineers than by the Government official for the latter has many alternative specifications of a similar character but modified for special purposes.

Gun metal, particularly those varieties which contain a

*A lecture delivered at the joint meeting of the London Section of the Institute of Metals and the Institution of British Foundrymen at the Institute of Marine Engineers, The Minories, London, on Thursday, December 13th, 1923.

larger proportion of tin than usual, have for many years been known to be subject to certain troubles. Long before the foundryman was made acquainted with either the name or character of eutectoids, he thoroughly appreciated that hard spots embedded in a softer ground mass was a common feature, and the machine shop men frequently spoke severely about the matter, and accompanying this was to be observed that old trouble, porosity. It was in early times a foundry practice, carried out rather by stealth, to reheat castings and cool them out in water, which was found to somehow cause the hard spots to disperse and the pores to fill up. The old time foundryman should have his due share of credit for this, he did not know that in a later generation this heat treatment would be introduced as a really scientific operation, in which the segregated hard particles, would be dissolved and retained in the softer constituent. Quite forty years ago, hydraulic buffer cylinders for gun mountings were cast at Woolwich Arsenal with water cooled cores, for this same purpose. As pointed out by Mr. Rowe, the brothers Primrose explored this operation and by scientifically heat treating gun metal doubled its ductility. Unfortunately, heat treatment is frequently out of the question as complicated castings with great differences in section, become so distorted as to be quite ruined. In these cases, either the casting must be discarded or some steps taken to close up the pores. Attempts have been made to deposit copper electrolytically, but little success attended these efforts. Tinning is not really practicable and does not seem safe or honest. One method which has been tried with success was to fill hydraulic cylinders, which were found to be slightly porous with a solution of silicate of soda, keep under pressure for some time and then expose to the air, the decomposition of the silicate by the carbon dioxide of the air, deposited silica in the microscopic pores and the weeping under hydraulic test ceased.

PHOSPHOR BRONZE

The introduction of phosphor bronze seems to have been the result of a natural effort to deoxidize the constituent metals in gun metal and to obtain a denser and purer alloy. The formation and evident value of the phosphide eutectoids in hardening the alloy appear to have been a later discovery. The earlier phosphor bronzes had very little phosphorus left in them, but it is to the presence of these hard constituents embedded in the softer alloy which conferred upon the alloy its value as a bearing metal, whilst its greater purity and freedom from oxides made it less corrodible.

The presence of lead in gun metal was largely frowned upon by Engineer Inspectors for it was known to largely remain insoluble in the rich copper alloy and to render it unreliable when subjected to varying stresses, but small quantities undoubtedly do contribute to soundness in casting. Its usefulness in making the alloy more readily machined is not of such importance in these as in the copper-zinc alloys.

STATUARY FOUNDING

A very important branch of foundry work which does not appeal with much force to engineers, is statuary founding. The craft has been held up to some very unmerited disapproval, if not scorn, in this country, but it would appear that in some cases in the past, sufficient care has not been taken to ensure that the alloys should be of such composition as would take a pleasing and enduring patina. It should be admitted that the asmospheric conditions in London and in many provincial cities, are very trying, but the metallurgist should be generally able to assist in ensuring that the metals used are quite suitable. The author had the good fortune to be called upon a few years ago to select the old guns which were to be melted for the statues of Lord Kitchener, Sir George White and several others, and was able after analysis of each gun to ensure that zinc was never present in more than minute proportion. The alloy being in all cases about 90 per cent copper and the remainder tin, with very small proportions of lead.

BELL FOUNDING

Another section somewhat akin is the art of bell founding. Here some other interesting problems arise. Mr. Hughes of Messrs. Mears & Stainbank, very kindly furnished some valuable information.

Church bells are made of copper 70 to 80 per cent, the remainder tin only; it is hard and brittle, the fracture being white. The castings require to be very highly finished, as no machining can be permitted apart from a very small amount necessary for tuning. The molds and cores are in loam, very thoroughly dried, the greatest care being taken to obviate irregular shrinkage either in the mold and core or in the casting.

The inscriptions which are cast upon church bells are also the subject of anxious care and skilled workmanship, as no finishing can be allowed.

The shrinkage is probably one of the most important problems, it is found to be very considerable and any irregularity would ruin the tone of the bell. In a bell with a thickness of 2½ inches at the sound zone, about 1/16th of an inch is the usual allowance, whilst in the overall dimensions ⅛ of an inch per foot is customary.

COLD ROLLING BRASS

The manufacture and casting of brass in its various grades is undoubtedly the largest section of non-ferrous foundry practice, and it is possible to touch only a very limited number of the problems involved.

Of the high class brasses, that used for cold rolled sheet and rod and drawn tubes and wire should have first attention, yet the immense amount of intensive study it has received during the past few years on all sides makes the selection of special and unexplored problems difficult.

As the use of this alloy containing 70 per cent copper and 30 per cent zinc has not such serious importance for the production of castings, as the high tensile brasses, the sphere of foundry problems is narrowed.

TEMPERATURE CONTROL

The selection of pure materials having been taken for granted the next problem is the control of temperature. Actual pyrometric control constantly applied in a brass foundry using crucible furnaces is very difficult, and much must be left to the experienced workman in this connection. Really the most urgent matter is the selection and training of the man in charge, when a good charge hand thoroughly appreciates that a badly overheated charge of metal will be full of blow holes, and will crack in rolling, and further, that dropping in some pieces of cold metal to lower the temperature will not of necessity cure the trouble, the foundry manager has probably a better safeguard against overheating, and unsound casting than by the provision of an elaborate pyrometric installation, but this does not infer that pyrometric control should not be used. Instruments suitable for the work should be at hand, they should be used consistently, and by their aid the intelligent workman is trained and interested.

The author has been a consistent advocate of the employment of pyrometers in all cases of treatment of metal at varying temperatures for the last 25 years, but that does not mean that the average foundryman should have a pyrometer inserted into every pot of metal drawn from his pit fires. Such practice tends to perfunctory and insincere

work, it is regarded as a hindrance and a nuisance, and becomes an object of contempt.

MOLD COATINGS

The treatment of the heated iron molds, with oil, black lead, rosin, etc., has been the subject of much discussion. The exact physical functions of the oil film and its behavior in relation to the inner surface of the mold and the solidifying metal was investigated and studied by Cartland. The practical manufacturing conclusion is that quite a number of oils and mixtures are perfectly efficient, if the workpeople are thoroughly familiar and expert in their use. An instance of this feature may be of interest. Two large foundries in the same establishment were turning out excellent ingot brass for rolling for cartridge cases. The shop foreman of one insisted on the use of seal oil for coating his molds, the other was equally insistent that only lard oil of a good quality could possibly be used. The little problem was solved in the human and easiest way, by letting them have what they wanted, providing the output were satisfactory, and in fact all was well. The annealing and rolling of these alloys, fortunately, are not pure foundry matters, or it is feared that this address would be unduly prolonged.

HOT WORKING BRASSES

The production of brasses suitable for hot rolling, extrusion and forging is quite an old industry. It is very improbable that George Frederick Muntz, when he patented his alloy of 60 per cent copper, 40 per cent zinc, was in any way concerned with or aware of the fact that such an alloy contained two ternary constituents, or that it was upon that fact that the capability of hot working depended.

One is apt to regard the growth of the high tensile brasses to date from the introduction of Muntz metal, and that is indeed so, although Law very justly points out that a brass containing 3 per cent of iron was suggested by Keir in 1779.

Experimentalists got busy on the problem of stiffening and also of deoxidizing the alloys, containing high zinc, and stereo metal, Aich's metal, and then Delta metal followed. Finally that wonderful alloy which we all learned to call manganese bronze was introduced and although every one is thoroughly aware that we should not give it the term bronze, but brass, it is feared that we shall have much difficulty in breaking ourselves of the bad habit.

HIGH-TENSILE BRASSES

The war brought very many foundries into close familiarity with forgeable alloys and high tensile brasses, and many interesting problems were presented to men who would otherwise have been quite unaware of them. An important matter particularly in connection with the production of fuse bodies, was the introduction of lead, chiefly of course to facilitate subsequent machining. In certain components lead had to be altogether excluded, on account of the danger of the production of lead picrate, by combination with the lyddite or picric acid; in the cases in which it was admissable there was a tendency sometimes to overdo it. Special care was necessary in the manipulation of forgings. As lead is not in solution in the alloy it is apt to liquate if the metal be subjected to prolonged heating, the author has found solid masses of lead of considerable size, in fuse castings, and has known of several cases of men being burned rather badly by splashes of molten lead from the drop hammers when stamping these fuse bodies from the chill castings.

High tensile brass castings have given more trouble to the foundry manager than any other excepting, perhaps, the recently introduced light alloys, and die castings.

In the early days of the war the number of firms willing to undertake large and intricate castings in the so-called manganese bronze, was very small, being limited to a few notable firms who specialized in this difficult work and the armament establishments.

The excellent paper presented to the Institute of Metals in March, 1920, by Neil Maclean, and the discussion it engendered contributed to by H. B. Weeks, H. D. Ellis, R. T. Rolfe and others, emphasizes the difficulties which were encountered by the skilled men who were unaccustomed to that class of alloy.

Yet Woolwich and the other war stores foundries had been producing gun mountings, cradles, buffer cylinders, breech parts and similar details of incredibly difficult and intricate design for many years in these alloys, regularly upwards of 35 tons per square inch tensile, with a yield point of not less than 14 tons, and excellent elongation, practically always over 20 per cent being invariably obtained.

These castings were from the usual composition alloy, and were without nickel.

The author well remembers the pale anæmic looking castings containing about 9 per cent nickel, which arrived in the difficult days of the war and the cry of apprehension which arose at their appearance.

The actual casting precautions and detail manipulations are beyond my powers, in this address at any rate, to even indicate.

The provision of a very large amount of molten metal, over and above that required for the actual casting, for the large heads, runners and risers. The judicious and skilful feeding, the expert stripping in order to lessen cooling stresses, the large and cunningly placed gates, and the many other precautions prompted by skill and experience, all contributed to the success of the work. In such cases as the 18 pounder gun cradles, any one who had the opportunity of seeing these castings on the field or after, cannot fail to have been amazed at the extraordinary toughness and strength of this wonderful alloy under intense shell fire.

For special services such as the large castings for sights of heavy naval guns, a much harder alloy, giving consistently 42 tons tensile, with very high yield point and correspondingly low elongation was used, castings produced were of the highest grade.

This metal was more nearly a beta brass, containing 55 per cent to 56 per cent copper, 40 per cent to 41 per cent zinc, the remainder manganese, iron and aluminum.

The great success of these high tensile brasses were apt to tempt the designer to use them in inappropriate situations. An incident which is sufficiently long past to permit reference to it came within the author's work. A certain gun mounting when under firing test, developed a very long recoil, with disastrous results to much of the gear. It was fitted with hydraulic buffer and an experimental air vessel or recuperator, somewhat in the form of an inverted bottle, this latter vessel in the so-called manganese bronze. An investigation proved that the ports in the buffer plunger were sharply eroded, almost as if by a triangular file, it was found that a minute quantity of sand had been carried from the interior of the cast air cylinder, by the high pressure air and fluid, into the polished steel buffer, braking had been ruined and the buffer rendered useless.

The culprit proved to be traces of core sand which from the form of the casting it was found impossible to remove, yet extraordinary care had been exercised in this. The vessels were finally cleared by means of dilute hydrofluoric acid, but the design was wisely abandoned.

The paper presented to the Institute of Marine Engineers, the manufacture of high class marine propellers

by the author's old friend and former colleague, Wesley Lambert, was a notable contribution to the information available on the scientific manufacture of heavy castings in these alloys.

MONEL METAL

Another difficult proposition before the non-ferrous foundryman is the production of good sound castings in Monel metal. Messrs. Weir have reduced this to a fine art. The high melting and casting temperatures involved, the enormous occlusion of gases, the necessity of "killing" the molten metal with magnesium, the precautions necessary in the way of large gates and feeders and provision for great contraction, makes the handling of this alloy very much like steel castings. Yet it would not be too much to say that alloys of this nature have a great future, on account of their wonderful physical and mechanical properties, and their resistance to corrosion.

LIGHT ALLOYS

The preparation and casting of the light alloys of aluminum and of magnesium present problems much too important and extensive to allow of their treatment in any short reference. It is indeed safer to defer their consideration until some member will give the institutes a comprehensive review of the difficulties which arise in making and using these metals.

Many of us can remember when aluminum was regarded as almost a chemical curiosity. When it became available on the large scale, it proved to be a very troublesome metal to cast. It is weak, draws and shrinks badly, castings warped, cracked and pulled themselves to pieces after manufacture. Alloys of aluminum and zinc and aluminum and copper were the only ones extensively employed, for many years. Professors Carpenter and Edwards put us on safe lines with the aluminum copper series and later the researches of Dr. Rosenhain and his staff at the national Physical Laboratory, gave us the wonderful series of alloys which has contributed so much to the success of all our aeronautical engineers and constructors. The preparation, working and heat treatment of Duralumin also may be claimed as a problem belonging mainly to the foundry. The development of the industry in the light alloys is indeed a triumph of co-operation between the actual manufacture and the scientific metallurgist.

DIE CASTING

Almost the last problem which it is proposed to place before the members is die casting.

This interesting branch of work is outside the ordinary foundryman's job, but it introduces an almost endless series of metallurgical propositions which are only equalled in severity by those involved in the design and construction of the dies.

A few samples which are on the table for the inspection of the members will give some idea of these difficulties. The alloys chiefly used are zinc base or white brasses, consisting of approximately 86 per cent zinc, 7 per cent to 10 per cent tin and 4 per cent to 7 per cent copper. Increased tin gives greater ductility, whilst increased copper renders the alloy harder. A small quantity of aluminum is sometimes added as a deoxidizer, but this must be introduced most sparingly as if any appreciable amount remains in the alloy, it induces the much dreaded swelling and distortion of the casting, and finally it cracks. This is particularly noticeable if the castings are subjected to high temperatures and a moist atmosphere. A temperature of about 180° F. in moist atmosphere has been found to act disastrously, if aluminum of 0.25 per cent is present.

Bearing metals of all grades, both tin base and lead base alloys, can be die cast with success. The tin base alloys varying from 93 per cent tin content to those with only 20 per cent tin, can be employed successfully. Whilst the lead base metals of the Magnolia type may also be used.

Many grades of regulus metals, specially resistant to the action of corrosive fluids, and those designed to resist the action of certain food stuffs and gases are used with success. An alloy largely employed is tin, 90 per cent, copper, 4 per cent, antimony, 6 per cent.

The aluminum group of metals can also be die cast, notably that known as No. 12, consisting of: aluminum 92 per cent, copper 8 per cent, a little magnesium is sometimes added, and occasionally from 1 to 3 per cent of nickel.

Die casting in yellow metals is more difficult as the high temperature involved and the action of the molten metal upon the dies, greatly shortens the life of the latter and makes long continuous runs a practical impossibility.

Many yellow metal so-called die castings, made in aluminum bronze containing 90 per cent to 95 per cent copper and 5 per cent to 10 per cent aluminum are in reality chill castings, and are not cast under pressure.

Aluminum and rich aluminum alloys are die-cast, using air pressure instead of a pump, as at the temperature necessary for the operation the pump plungers are rapidly acted upon.

The author has not yet found an iron alloy which will really withstand this corrosive action, although every one of the well recommended alloys has been experimented with. Refractory linings of rare alkaline earths and oxides are sometimes employed to protect the metal containers, with a considerable measure of success.

The dies in most cases are water cooled.

The foundryman should not forget that the pioneer of die casting and also of much of the most beautiful and accurate work in metal casting is the printer's engineer. The inventions of the linotype, intertype and similar machines, of the monotype machine, and lastly the stereo casting apparatus of Messrs. Hoe and the wonderful autoplate machines and the Winkler casting machines, should be seen by every person engaged in handling molten metal. The printing craftsman is in no way behind the orthodox foundryman in the excellence of his work. Further, much of his work is automatic die casting of the greatest accuracy.

The feature of the long distance between solidus and liquidus is of great importance. In almost all die castings very few alloys consist solely of a binary or ternary eutectic, a period of gradual or fractional solidification is in most cases a necessity for the production of sound castings.

CO-OPERATION BETWEEN FOUNDRYMAN AND METALLURGIST

The last problem, and one which is very serious, I feel I am daring much, in presenting to you. It is the absolute need for close and friendly co-operation between the man responsible for the work of the foundry and the scientific metallurgist. A real working union is necessary. I ask the foundry manager to believe that the metallurgist is yearning to help, to place the results of his studies and researches at the work's disposal, to learn more of the difficulties so that he may bring his training to bear on their solution. As an old works metallurgist, I also beg the scientific worker to meet the foundryman as much as possible, the breadth and depth of his knowledge and wisdom will be a revelation. The scientist has a language of his own, let him try to forget it in factory work. It is one of the greatest barriers to the mutual co-operation which we all desire. Meetings such as this, between the foundry manager and the highly scientific men and women engaged in the profession of metallurgy is a proof that this personal problem is virtually solved.

Aluminum and Copper Fabricated By Welding

Illustrations of the Application of Welding Process to Fabrication of Plant Appliances*

A sheet metal appliance manufacturer in fabricating various types of equipment by welding aptly illustrates that a wide diversity of production welding is possible in this field, especially when the adaptablity of the oxy-acetylene process is fully understood.

WELDED COIL FOR PREHEATING FUEL OIL

Most of their products involve the welding of copper, aluminum, Duralumin, monel metal, or Everdur (a new acid resisting metal).

One class of work done by this concern is the construction of a variety of pipe coils. A type completed a short time ago is a large resistance coil which was fabricated for an electric power plant to serve two purposes, dissipation of current and preheating of fuel oil. This coil was about 14 ft. high by 16 ft. wide, was built of copper tubing, and all joints were oxy-acetlyene welded. After completion it was tested at 500 lbs. hydrostatic pressure, and no leaks developed.

A second type of coil used for cooling purposes and built of 1¾ in. No. 13 gauge copper tubing contained about 3,000 ft. of tubing and had 180 welded joints. A difficult construction feature overcome by the oxy-acetylene process in this case was the brazing of yellow brass nipples to the ends of the copper tubing.

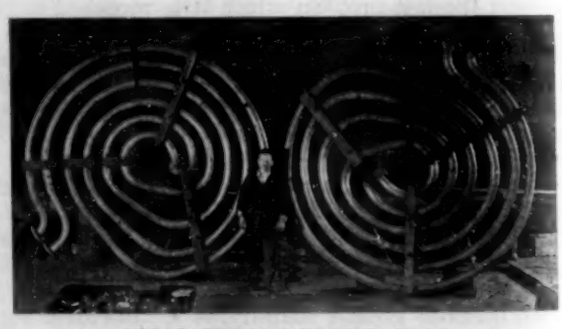
Still another type of coil fabricated by this concern is one used in the heating kettles of sugar refineries. These coils are also fabricated from copper tubing and are oxy-acetylene welded. The speed with which such welds are made greatly exceeds that accomplished by the use of a coppersmith's gas torch, one of the old means of doing this work. In welding most of these coils, which are built up by progressively adding sections of tubing, the ends of the tube to be welded are narrow flanged, and then edge welded without the use of a filler rod.

Stills for chemical distillation purposes constitute another welded product. The body of the one illustrated was fabricated from a special alloy sheet aluminum. The dome and coils are of pure sheet aluminum, while the connection flanges welded to the dome are cast aluminum. The goose neck was made by forming two pieces of sheet aluminum and welding them together. Other welded joints can be readily seen in the accompanying photograph. Bolted flanges were provided in order to facilitate the removal of the goose neck and coils, and the dome was bolted to the body of the still, for the same purpose. The completed still was subjected to 60 lbs. hydrostatic pressure and came through the test without showing even a pinhole leak.

There are certain specified practices adhered to in this shop in the interest of obtaining uniform work of good quality. In order to hold the work in position for convenient welding, various simple clamps consisting of iron strips and bolts are used. In welding light gauge metals the practice of narrow flanging the edges and making a weld without a filler rod is adhered to, while on sheet metals ⅛ in. and heavier a butt weld is made.

The fusion point and specific gravity of aluminum oxide are higher than those of the metal itself. Hence, in welding aluminum, the oxide sinks to the bottom of the weld and can not be melted without burning the metal. It is therefore necessary to float this oxide to the surface with the aid of a flux, after which it is removed mechanically by means of a paddle. A high grade of sheet aluminum flux is dissolved in water and then is applied to the seams to be welded by means of a brush. The filler rods used are of practically the same composition as the metal to be welded.

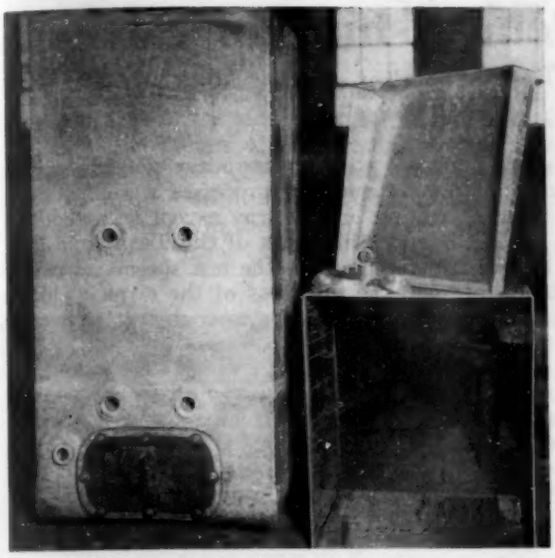
Before beginning a weld the operator tests his flame on a piece of scrap metal, a practice which is considered advantageous by this particular shop. Copper bubbles actively under an excess acetylene flame, while it oxidizes rapidly under an excess oxygen flame. Sheet aluminum, while it oxidizes readily under an excess oxygen flame, is not injured by a flame containing a slight excess of acetylene. These sheet metals have another characteristic, comparatively high thermal conductivity, which requires definite practices in welding them. Owing to this, excessive expansion and contraction are not encountered, but the metal within a few inches on either side of the seam must be progressively heated with the envelope flame of the blowpipe so as to prevent rapid dissipation through the metal of the heat applied to the point of welding.



SUGAR BOILING KETTLE COILS

Other production welding done by this company includes hoppers, fabricated from sheet copper, and aluminum chemical sedimentation tanks. The tanks are approximately 3 ft. sq. by 7 ft. deep and are built of three sections welded together. The metal used is ¼ in. pure sheet aluminum. The bottoms of these tanks are given a slight batter. They are formed by shearing a piece of sheet aluminum to the required dimensions, then cutting a square piece out of each corner, and finally bending up

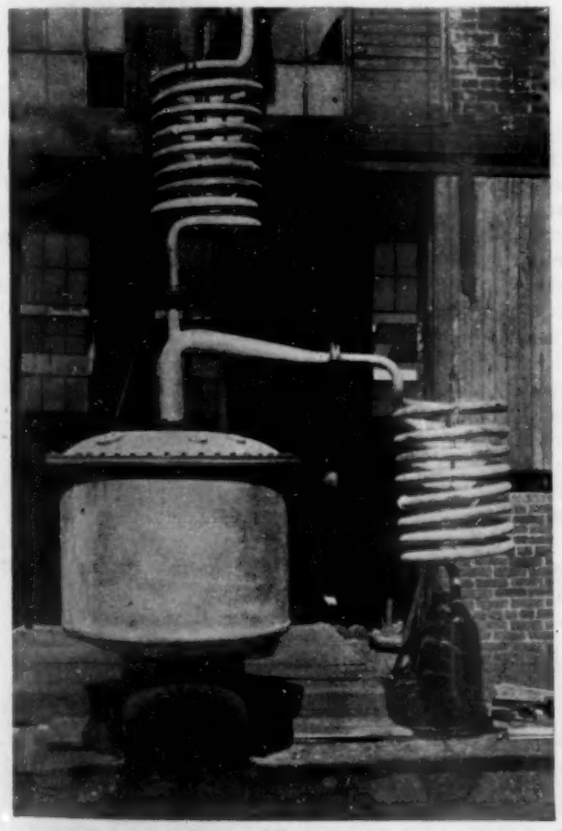
*From Oxy-Acetylene Tips.



ALL WELDED CHEMICAL SEDIMENTATION TANK

the projecting rectangles. The piece then has the appearance of a rectangular pan, deeper at one end, and is finished by welding the corner joints.

The next step is to form two hollow rectangular prisms of the same circumferential dimensions as the bottom by making four right angle bends in a sheet and butting the edges, which forms a seam, in the middle of one of the faces of the prism. The side seams are welded and then the two prisms which form the body of the tank, and the



ALUMINUM ALLOY STILL

prepared bottom are welded together with butt welds. Next, holes to acommodate the cast aluminum fittings are cut in the proper places and the fittings are welded in. Finally a rectangular flat top is welded in place and the last operation consists in adding the steel flange around the cleanout hole. To do this the proper opening is cut through, permitting the aluminum sheet to be bent up around the flange, as shown in one of the photographs. This is a ½ in. radius bend through 180° right at the lower circumferential weld. It is interesting to see that an oxy-acetylene weld on sheet aluminum will stand this amount of cold working.

Base Price for Metal

Q. Would you kindly inform me how the Base Price is determined on sheets and rods in the various mills. Is it by a universal metrod, or does each plant work out its own base? I am particularly interested in copper, brass, and nickel silver?

A. The base price for copper and brass rods and sheet, and nickel silver, and in fact all metal products made by the mills, is arrived at by a computation of cost of materials, cost of production and overhead items, as determined by experts in the various mills. Each mill, of course, figures its own prices. The base fuctuates with the price of copper, and it becomes a case of "follow your leader" when business is offered.

The discounts allowed on extras over base price are sometimes weird, but they usually bring the business. Of course, the base price is sometimes shaded when attractive business is offered and the metal desired happens to carry no extras, that the order may specify simply base conditions, as for instance in the case of sheet brass from 2 to 8 in. wide and No. 20 Brown & Sharpe gauge. It all depends upon market conditions. L. J. KROM.

Rolling Light Gauge Sheet Brass

Q.—We are finishing up a lot of brass in light gauges, 29 to 35 B and S and are planning to put in a new mill to handle this. What size rolls and what speed will handle this work best?

A.—You don't say what the width of the metal is, but assuming it runs from 4 in. to 7 in. wide a 12 in. x 18 to 20 in. steel mill running about 70 R.P.M. will handle this class of work economically. Unless you are sure of enough orders for this class of metal to keep the rolls busy, I would suggest putting in a 16 in. x 24 in. mill running about 40 R.P.M. This would handle the work you have in mind and be better adapted to general work in case the special work drops off.—W. J. PETTIS.

Recovering Gold Scraps

Q.—What is the usual method of recovering gold from dentists' scrap?

A.—The simplest method of recovering the fine gold from dentists' scrap is to dissolve the scrap in a mixture of 50 per cent pure nitric acid and 50 per cent water, heated to 120° F. or more.

For the purpose, the usual acid porcelain chemical dishes should be used, the heating done over a Bunsen flame or on a heated sand bath. The nitric acid mixture dissolves the copper and silver and holds the metal in solution as nitrates. The gold is insoluble in the nitric acid so separates in the form of small gold spangles.

The gold may be filtered from the solution and when thoroughly washed, may be remelted to form ingots or buttons. It would be advisable to secure a small treatise on the refining of gold, etc., to obtain complete detail as to equipment, etc.—C. H. PROCTOR.

The Tarnishing and Detarnishing of Silver

Causes of Tarnishing and Comparison of Methods of Removal. Properties of Moss Silver.* Part 2.

By G. W. VINAL and G. N. SCHRAMM

Other methods of tarnishing silver.—Silver is tarnished by the action of chlorine and oxygen as well as by sulphur. The fumes arising from a dilute solution of hydrochloric acid readily attack sterling silver as shown in Fig. 7. Pure silver is not as easily tarnished under the same conditions.

FIG. 7 TARNISHING OF SILVER BY CHLORIDE.
These strips were immersed for about one-half their length in a dilute solution of hydrochloride acid. The tarnishing took place above the solution. The sterling silver strip (upper) is much more tarnished than the pure silver strip (lower).

Hydrogen peroxide attacks silver as shown in Fig. 8, producing a black tarnish that is particularly heavy on sterling silver. Tarnishes were also produced when strips

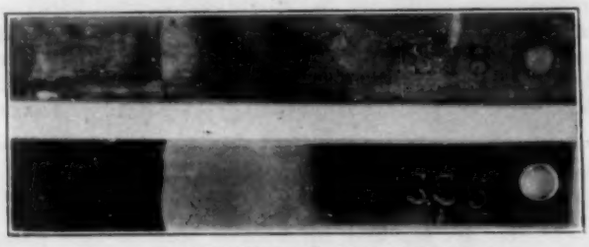


FIG. 8 TARNISHING OF SILVER BY H_2O_2.
The lower ends of these strips were immersed in hydrogen peroxide. The sterling strip (lower) is much more tarnished than the pure silver strip (upper).

of silver were heated to incandescence. Sterling silver tarnishes heavily and almost instantly, while the effect on pure silver is negligible, Fig. 9. This affords perhaps the simplest means of distinguishing pure silver from sterling silver.

FIG. 9 SILVER TARNISHED BY AIR.
The pure silver strip (upper) and the sterling strip (lower) were heated to incandescence simultaneously. The sterling strip shows much more tarnish.

Sterling silver is readily tarnished by the direct application of sulphur. The strip shown in Fig. 10 was rubbed with a tuft of cotton on which was a small amount of flowers of sulphur.

Standard tarnish.—As a result of the various experiments on the tarnishing of silver it was decided to use as the standard tarnishing condition one per cent hydrogen sulphide and five per cent sulphur dioxide with moisture present for fifteen minutes' exposure. This permitted the preparation of reproducible test specimens in a short time and without too heavy a tarnish. Experiments on the detarnishing processes were made on test specimens prepared in this way except as noted.

(b) Weight and Thickness of the Tarnish Film.

By careful weighings of the test specimens before and after tarnishing, the thickness of the tarnish film can be calculated. It is of interest to compare the results obtained with the approximate thickness of the silver layer of plated ware. The tarnishes which were measured were purposely made somewhat heavier than the standard and heavier than would ordinarily be allowed to occur in the household. Table 3 shows results of the experiments on pure silver, sterling silver, and plated silver.

TABLE 3

WEIGHT AND THICKNESS OF TARNISH FILM

Material	Specimen	Original Weight (grams)	Final Weight (grams)	Gain (grams)	Equivalent Ag_2S (grams)	Thickness of film (microns)
Pure silver...	S 1	7.9379	7.9384	0.0005	0.0039	0.18
	S 2	7.5016	7.5020	0.0004	0.0031	0.15
Sterling silver.	SS 2	7.4853	7.4863	0.0010	0.0077	0.36
	SS 10	8.0787	8.0797	0.0010	0.0077	0.36
Plated silver..	N 8	13.5287	13.5294	0.0007	0.0054	0.25
	N 9	13.7572	13.7581	0.0009	0.0069	0.32

Two samples each of pure silver, sterling silver, and silver plated on nickel, were tarnished in an atmosphere of 2 per cent hydrogen sulphide and 10 per cent sulphur dioxide, moist, for two hours. The tarnish was black with reddish tinge. Area of strips 30 cm^2, approximately. The thickness of film was calculated on the basis of a density of 7.1 for silver sulphide, gain in weight assumed to be sulphur.

The thickness of the film on the plated ware is about one per cent of the estimated maximum thickness of the plating, which is about 25 microns or 0.001 inch. These results show again that sterling silver tarnishes to a greater extent than pure silver under identical conditions. The computed values for the plated silver are intermediate between values for the pure silver and the sterling silver.

(c) Factor Which Accelerate and Retard Tarnishing.

In the preceding sections it has been shown that the tarnishing of silver by hydrogen sulphide gas is greatly accelerated by the presence of moisture and sulphur dioxide. Besides these conditions, which are external to the silver, the surface conditions of the silver are of importance also. The presence of certain films on the surface may distinctly retard tarnishing, and other films greatly accelerate it. Unfortunately the factors which may retard tarnishing when the silver is immersed in solutions may not exert the same protective action on the silver when it is exposed to gases that cause tarnish.

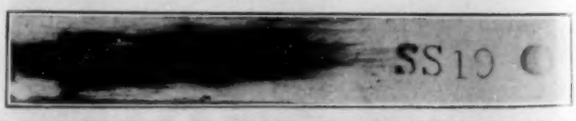


FIG. 10 TARNISHING OF SILVER BY THE DIRECT APPLICATION OF FLOWERS OF SULPHUR.
This is a strip of sterling silver. Pure silver is not as readily tarnished.

In tarnishing liquids.—Test specimens of pure silver and sterling silver were tarnished in a solution of N/10 sodium sulphide to which sulphur had been added. Only the lower portion of the strip was dipped in the solutions whose effect in retarding the tarnish was to be

*Published by permission of the Directors of the Bureau of Standards, Department of Commerce. Part 1 was published in our January issue.

determined, and then a somewhat greater portion of the strip was dipped in the tarnishing solution. In this way a striking difference in the tarnishing effect was observed on some strips. Solutions of sodium thiosulphate, corrosive sublimate, sodium chloride, and ammonium hydroxide retarded the tarnish. The effect of ammonium hydroxide was apparent in the case of sterling silver, but was hardly noticeable in the case of pure silver. Samples

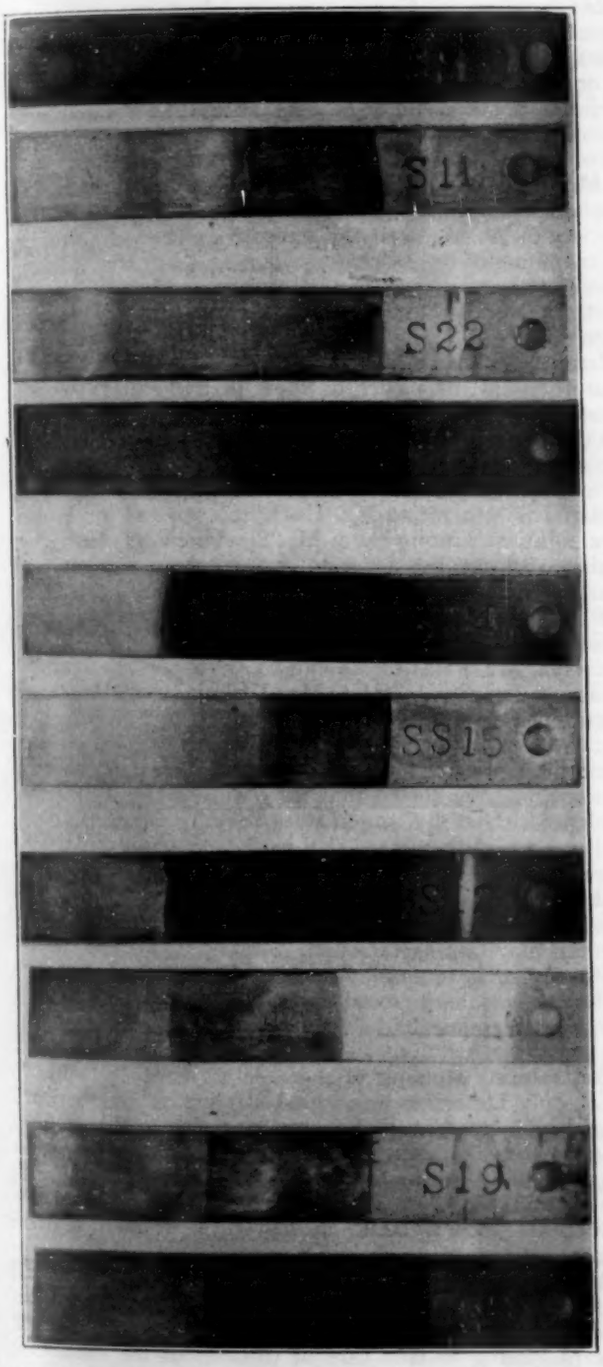


FIG. 11 EFFECT OF VARIOUS REAGENTS IN RETARDING TARNISHING.

Compare retarded portions at left with the tarnished portions in the center.

were rinsed and dried between immersions. The results of these experiments are shown in Fig. 11.

Hydrogen peroxide, which is active in tarnishing silver when used by itself, can be made to retard tarnishing by the addition of ammonia. In Fig. 11 the specimens show a retarded tarnishing on the left as compared with the center portion which was untreated. The specimens include pure silver strips (S) and sterling silver strips (SS) treated as follows, reading from the top of the figure downward:

SPECIMEN	TREATMENT TO RETARD TARNISHING
SS 31, S 11	Hydrogen peroxide with ammonia.
S 22, SS 29	Ammonia water.
S 24, SS 15	Strong solution sodium chloride.
S 12, SS 26	Very dilute solution mercuric chloride.
S 19, SS 25	N/5 Sodium thiosulphate.

The results with the sodium thiosulphate were perhaps the most satisfactory and are readily applicable.

In gas atmospheres.—Additional experiments to determine the retarding or accelerating effect of various substances were tried also for specimens which were tarnished in a moist atmosphere by hydrogen sulphide. The results of this latter series of experiments contradict in some respects those obtained in the former experiments. For example, it was found that sodium thiosulphate was without significant effect in retarding tarnishing when the specimens were exposed to hydrogen sulphide gas in a moist atmosphere. It was found that when the silver specimens had been dipped in a dilute solution of hydrochloric acid the tarnishing was retarded, but when they were dipped in a dilute solution of caustic soda, the tarnishing was accelerated, Fig. 12. This is the result which would naturally be expected since alkaline solutions readily absorb hydrogen sulphide gas. Since dilute hydrochloric acid had been found to retard tarnishing, an experiment was tried in which dilute vinegar was used, but the use of vinegar accelerated rather than retarded the tarnishing. One specimen, part of which was partly covered with a film of butter, showed increased tarnish where the butter was present, but a similar specimen having a coating of lard showed a definite retarding effect on tarnishing. The most startling effect in accelerating tarnish was found to be due to a film of soap. Samples of laundry soap and a pure white soap were used on the specimens of sterling silver shown in Fig. 13. The tarnishing on the portions of these strips, which were covered with the soap film, was the heaviest tarnish observed in any of these experiments. This fact has an important bearing on the tarnishing of silver in the household, since it is evident that the soap film must be completely removed from the silver to avoid rapid tarnishing.

There are other surface conditions of the silver that accelerate the tarnishing. It will be shown in a later section of this paper that finely divided silver in the moss condition is left upon the surface of the silver after the reduction of silver sulphide. This may have an accelerating effect on the subsequent tarnishing. In Fig. 14 are shown specimens of sterling and pure silver, the ends of which had been tarnished in hydrogen peroxide and then electrolytically reduced to the moss silver condition before they were immersed in a tarnishing solution. The figure shows excess tarnish in both cases where the moss silver was present, but the sterling silver is more affected than the pure silver.

This paper will be continued in an early issue—Ed.

Meeting of the New York Platers

The New York Branch of the American Electro Platers' Society met for its 15th annual banquet on February 23rd, 1924, at the Aldine Club, New York. The afternoon session opened with **Mr. Morningstar** presiding. After the meeting was called to order, Mr. Morningstar introduced **Charles H. Proctor,** who then took charge of the entire session.

Mr. Proctor made a speech of welcome to the members and the visitors present and gave his impression of plating conditions throughout the country as he had found them in his travels. After considerable investigation and much thought he had come to the conclusion that the greatest cause of trouble in nickel solutions was hydrogen.

Mr. Proctor gave a very interesting recommendation and suggestion to the effect that an Institute of Electroplating should be founded which would act as a central research bureau, in charge of permanent, paid workers who would be at the call of members when they were in difficulties. This, of course, was put forward only as a possibility, but it holds up an attractive future.

The first paper was delivered by **J. S. Pedro** on the subject of brass plating on antimonial lead. Mr. Pedro outlined methods of plating brass on antimonial lead fixtures beginning with the polishing of the original casting fixtures and carrying it through the plating in a cyanide solution. He finished his paper with a series of difficulties encountered and their solutions.

K. W. Schwartz of the Metal & Thermit Corporation gave a short talk on chromium plating and showed some samples of chromium plate, bright plated. He described the properties of this coating and then announced himself as willing to answer all questions which he could. This was the signal for a general uprising on the part of the audience, who threw questions at him thick and fast, most of which Mr. Schwartz was not in a position to answer because of the fact that the process used was still in the experimental stage and could not be divulged. He referred, however, to his paper before the American Electrochemical Society on Chromium Plating*. From the various questions and answers, however, it developed that a current density of 100 to 125 amperes per square foot at 3 to 6 volts could be used. Chromium plated into recesses with difficulty, but had been thrown into a one-inch hole. It had been plated as heavily as 1/16 to ⅛ of an inch in 6 hours, coming out bright. It is necessary to replenish the solution with salts since anodes do not completely feed it. Chromium is particularly resistant to nitric acid but will be attacked slowly by hot sulphuric acid and rapidly by hydrochloric acid.

Mr. Wernlund asked if chromium could be recommended against salt spray test, stating that he had had some difficulty with it himself, but opinions seemed to vary at this point. Mr. Schwartz stated, also, that although lead anodes could be used in the chromium plating solution, the use of chromium anodes gave a brighter deposit.

Mr. Proctor read a paper on the Value of Nickel Chloride as a Conducting Factor in High Speed Hot Nickel Solutions. He showed that chlorine eliminated the hydrogen from the hot nickel solutions by forming hydrochloric acid which aided the conductivity of the solution. He gave a solution which consisted of the following:

Water	1 gallon
Single Nickel Salts	3 ozs.
Nickel Chloride	3 ozs.
Boracic Acid	2 ozs.

This solution could be used at 125 to 140° F. and about 40 amperes per square foot, and 6 volts. Such a solution, he stated, would be very rapid. He recommended also the use of cast nickel anodes rather than electrolytic.

A number of speakers were then called upon to say a few words. **Mr. Kobel** described a remedy for nickel itch which consisted of a very simple mixture. A saturated solution of Castile soap in lukewarm water into which the plater could lay his hands, would neutralize the acids in the sores. Then the use of zinc stearate for 4 or 5 nights in succession would complete the cure. Cyanide solution in open cuts should be treated with iodine at once and tied up to prevent additional attack. This would effectually keep sores from coming on.

Mr. Hazucha of the Chicago Branch told how he had explained the purpose of the American Electro-Platers' Society to **W. M. Webster,** executive officer of a number of manufacturing associations, among them the National Association of Brass Manufacturers, and how he had brought Mr. Webster around to a meeting of the Chicago Branch. As a result, Mr. Webster became a strong adherent of the Platers' Society and promised to do everything in his power to show manufacturers what a beneficial organization it was. Mr. Hazucha also brought up the question of a statuary bronze finish which could be put on without a copper dip, and which could be turned out in production quantities. A number of suggestions were made to Mr. Hazucha's request for a positive solution, among them **Mr. Sizelove's** solution, consisting of 8 ozs. hyposulphite, 4 ozs. copper sulphate and 2 ozs. nickel sulphate in 1 gallon of water.

F. C. Mesle, Editor of the Monthly Review, spoke indicating the rapid progress of the Electro-Platers' Society. **Mr. Faint** of Newark, announced the Newark Banquet for April 26th. **Mr. Uhling** of Philadelphia announced the Philadelphia Banquet for March 21st. **Dr. Lukens** of the University of Pennsylvania, told something about the research work going on at that institution. He stated that they were interested in the co-deposition of hydrogen with nickel. So far as they had gone, and they were still in the experimental stage, it seemed that a flow of the electrolyte toward the cathode, thus replenishing the spent solution with fresher and richer electrolyte seemed to give better results than air agitation.

Royal Clark was called upon and gave his experience with the hot, high speed nickel solutions. (Mr. Clark had been mentioned by Mr. Proctor the pioneer in the use of these solutions.) Mr. Clark cited a case of a nickel solution running at a temperature of 150° F., to which only hot water was added for several months until the solution stood at 2° Beaume operating at 2 volts and 7 amperes per square foot, on work closely nested, with considerable throwing power demanded of the solution, the cause of the close nesting in the tanks. He had deposited as much as .0015 inches per hour on cast iron shears.

Mr. Gehling, Philadelphia, announced that he and all of his branch were deeply interested in the idea of an experimental laboratory, in other words, an Institute of Electro-Plating to take care of troubles of the members. He stated that the Philadelphia Branch had a scheme in mind for putting in an experimental laboratory for plat- to support. Some manufacturers had been solicited for funds but the returns were small. It was too heavy an expense for the Philadelphia Branch to bear unaided, so they contemplated, at least at the present time, taking in job plating work to support it. This would not interfere with other job platers because the work would be lim-

*See THE METAL INDUSTRY for November, 1923, P. 441.

ited in quantity and non-competitive in character. Mr. Sizelove announced that the Newark Branch was to hold a special meeting on research in nickel plating at which **Dr. Blum** of the Bureau of Standards would speak.

The afternoon meeting was followed by a banquet which was as usual a sumptuous affair. After the banquet came the dancing which lasted until late in the evening. The meeting was a typical New York Branch affair, with one of the largest attendances ever recorded, full of interest and life, and most enjoyable from beginning to end. The various committees involved in managing it are to be congratulated for their earnest work and the success of their efforts.

Etching

Accepted and Reliable Methods of Etching for Different Purposes

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

ETCHING STEEL

There are two methods used in etching steel articles, such as trade marks, etc. One is termed the transfer method, the other the rubber stamp method.

The first consists of having the trade mark, etc., applied to a lithographing stone. A heavy black printers' ink is applied to the stone with the usual printer's roller, and the impression is taken off on bleached white tissue paper. The transfer thus produced, while still wet, is applied to the steel article to be etched and allowed to dry. The paper is then removed by moistening with wood alcohol, which loosens the paper from the ink impression, which acts as the etching ground. A border is usually arranged in the transfer, and an asphaltum varnish or modeller's wax is arranged around the border to prevent the etching acid from spreading.

One part nitric to two or three parts of water is used as the acid etching medium. After the depth of etching required is produced the acid is diluted and washed off. The wax or other stop-off is removed, the ink is removed with benzine or gasoline, and the etching is completed.

The second method is the rubber stamp method. This method consists of having the trade mark, etc., with a border made up in the form of a rubber stamp. A solution is prepared by dissolving gum guaiacum in acetone, which may be colored with a little aniline blue or violet. The gum resist should be heavy but still fluid. The next operation is to have a suitable pad made, such as the regular inking pad used in connection with rubber stamps. The pad should be thicker, however, so that it will hold a strong solution of caustic soda.

A strong solution of caustic soda should be prepared in the proportion of two to three pounds of caustic soda 76% per gallon of water. The caustic soda should be applied to the pad. The manipulations then are as follows:

1. The steel parts are covered with the gum guaiacum varnish, which is allowed to dry.
2. The rubber stamp is applied to the pad and takes up the strong caustic soda solution on the design.
3. The rubber stamp should be applied to the gum guaiacum etching ground for a moment and then removed. The caustic soda eats through the gum to the steel. The steel should then be washed to remove the caustic soda.
4. Apply the nitric acid etching solution until the etching is deep enough. Then remove by washing in water.
5. Remove the gum guaiacum etching ground with wood alcohol, and dry out in fine maple wood sawdust.

A little experimenting with this procedure will enable you to etch successfully. In the transfer process any number of transfers may be applied to the steel part, so they can dry thoroughly before removal with the alcohol as outlined.

ETCHING ALUMINUM

Q.—I am doing some experimental work in etched name plates, and am having some difficulty in etching on aluminum. We are etching successfully on brass with chloride of iron, but when we try to use this etching agent on aluminum the resist is lifted off.

A.—Dilute solutions of hydrofluoric or hydrochloric acid can be used with better results than iron chloride. The latter material when in contact with aluminum apparently precipitates the iron it contains, which prevents the acid from giving the etching value as results in etching brass. When the iron deposits it is possible that the acid runs beneath the etching ground and the resist lifts off as noted.

Caustic soda or potash are alkalies that will reduce aluminum, but as a rule attack the etching ground.

Sodium and ammonium fluorides can possibly be used, but dilute hydrofluoric or hydrochloric acids should give the best results.

ETCHING CUTLERY BLADES

Q.—We are interested in securing a simplified process for etching cutlery blades of the lower grades. We have in mind a process which we understand is commonly in use, whereby the etching acid is applied directly to the steel by means of a stamp of rubber or other material.

Our usual method is to form a stencil by shellacking the blade and applying a caustic stamp, the acid being allowed to lie on this stencil until it has eaten a deep impression in the steel. This gives a very fine deep etching, but is a rather expensive process. We have been unable to work out successfully the simpler process outlined above.

A.—The majority of cutlery manufacturers use the same method as yours, that is, the shellac or gum guaiacum resists the eating through of the caustic soda or potash applied with the rubber stamp washing and finally acid etching. Others use the transfer method. The design is taken from a small lithographic stone upon bleached white tissue paper. A heavy, thick printer's black ink is used as the printing factor.

The tissue paper transfer is now applied to the steel and in its tacky condition leaves the ink impression when the tissue paper is moistened with denatured alcohol and removed. The etching ground design so applied acts as the acid resist. This method perhaps would not reduce the cost. It might be possible to use a soft rubber stencil in which the design was cut and then etch the exposed steel through the rubber stencil with a sand blast, using glass sand, coarse pumice stone or some other similar abrasive as the etching factor. A good deal of imitation acid-etched glassware is finished by sand blasting, using soft rubber stencils as protectors.

Second Annual Metal Finishers' Exposition

Preliminary Announcement Concerning the Exposition in Dayton, Ohio, April 14-19, 1924

The interest and demand for space, as a result of the first Metal Finishers' Exposition, held in Dayton last year, has made it necessary to secure a large exhibition building. This modern structure, the exhibition building of the Montgomery County Fair Grounds in Dayton, Ohio, was designed specifically for exhibition purposes and, with its single ground floor, high trussed ceiling, perfect light and ventilation, is well suited as to space, facilities and arrangement. Twice as many booths will be provided as was possible last year.

The exhibition building is splendidly located and easy of access from hotels and depot by cars or automobiles. It is within walking distance of one of the world's largest manufacturing plants wherein will be found the most modern finishing equipment in actual use and whose products are second to none for durability and beauty of finish.

The purposes of the exposition may be expressed as follows:

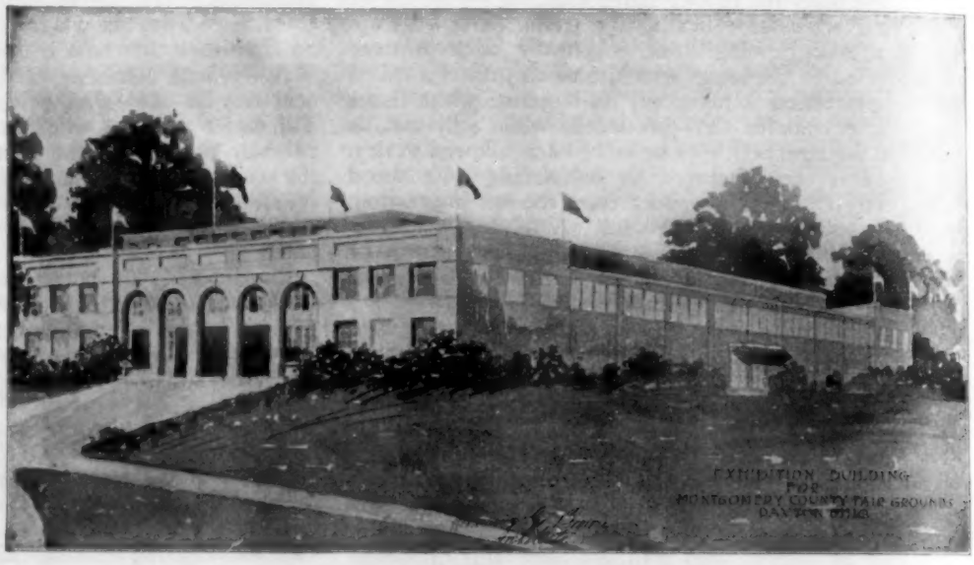
1st. To acquaint the buying public with the various phases of the metal finishing business necessary to produce the decorative and protective finishes which they consider so essential on all products.

2nd. To acquaint the manufacturer and dealer of these products with the many materials, processes and equipment necessary to produce these finishes, and to demonstrate their application and use.

There is no exposition which is more broadly beneficial in its appeal to the manufacturer, dealer and public, and gives them more for their effort.

Here an opportunity is provided for all three to become acquainted with the raw materials and their use, and every phase of the labor and skill entering into modern finishes. A canvass of last year's exhibitors shows that every one benefitted through actual sales, new prospects and ideas.

This is not a profit making project, but an educational affair. It will profit everyone, however, by stimulating an interest in, and a better knowledge of the raw materials, equipment and processes employed in the various finishing arts.



A MODERN FAIR BUILDING ON FAIR GROUNDS AT DAYTON, OHIO

Silver and the Pittman Act

The most important event of the year, and the one causing the greatest interest in all parts of the world where silver plays its part in financial and commercial circles, was the completion of purchases under the Pittman Act by the United States Government.

It was not expected at the beginning of the year that the balance of 50 million ounces would be filled before November, but due to very heavy purchases during March, with the privilege to sellers of delivery against sales up to October 1, 1924, the Director of the Mint announced on May 29th that purchases under the Act were suspended.

This cessation of buying by the Government had been the nightmare of silver producers for many months, and with this artificial influence on silver removed a fall in price was expected in many quarters. The worst did not happen, however, as silver prices receded only slightly and have remained fairly steady for the balance of the year.

This condition has been due to the large world demand, and also to the fact that, as a result of the Treasury purchases for future delivery, the full production of the United States has come on the market gradually. At the end of the year there still remained to be delivered to the Mint under the Pittman Act (at the price of $1 per ounce) 1,433,000 ounces.

Silver producers in this country, seriously considering the probable adverse effect on the price likely to result from the cessation of Government purchases, have been active in their efforts to expand the market for silver sufficiently to allow for the absorption of their output at attractive prices. The plan of a loan to China of 200 million ounces to be paid back in ten or fifteen years at $1.00 per ounce was even considered.

A Senatorial Gold and Silver Commission was created by the U. S. Senate to investigate the production, sale and uses of gold and silver, and is now actively engaged in this work. A Silver Export Association was organized at Reno, Nevada, last September, and an executive committee of this association was appointed to endeavor to control the price of silver by concerted action in marketing their product. It is to be hoped that the result may be at least stabilization of price and increased demand for the white metal.—HANDY & HARMAN.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

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Contents

Meeting of the Institute of Metals Division..... 95
A Report of the Sessions Held in New York, February 18-20, 1924.

Storing Crucibles 98
A Discussion of the Theoretical and Practical Aspects of Crucible Storage Methods.
By JONATHAN BARTLEY

Loose Pulley Troubles..... 99
By P. W. BLAIR

Monel Metal Golf Heads..... 99
By P. W. BLAIR

Blanking Punches and Dies for Aluminum..... 99
By P. W. BLAIR

Molding Machines and Molding Practice..... 100
The Principles of Machine Molding and How to Distinguish Between Different Types for Different Classes of Work.
By R. R. CLARKE

Casting Metals 103
A Variety of Melting and Molding Troubles and Their Solutions.
By W. J. REARDON

Some Foundry Problems..... 104
General Difficulties in Casting Metals and Alloys as Met in British Practice.
By A. H. MUNDEY

Aluminum and Copper Fabricated by Welding... 108
Illustrating the Application of Welding Process to Fabrication of Plant Appliances.

Base Price for Metal..... 109
By L. J. KROM

Rolling Light Gauge Sheet Brass..... 109
By W. J. PETTIS

Recovering Gold Scraps..... 109
By C. H. PROCTOR

The Tarnishing and Detarnishing of Silver..... 110
Causes of Tarnishing and Comparison of Methods of Removal. Properties of Moss Silver. Part 2.
By G. W. VINAL and G. N. SCHRAMM

Meeting of the New York Platers..... 112

Etching 113
Accepted and Reliable Methods of Etching for Different Purposes.
By C. H. PROCTOR

Second Annual Metal Finishers Exposition..... 114
Preliminary Announcement Concerning the Exposition in Dayton, Ohio, April 14-19, 1924.

Silver and the Pittman Act..... 114

Editorials 116
Institute of Metal Division
Research in Copper and Brass
Institute of Electro-Plating
Hot Zinc Coating
Value of Silver

Correspondence and Discussion..... 118

New Books 118

Technical Papers 119

Shop Problems 120

Patents 122

Equipment 123
Rebuilding by Electro-Deposition
Cleaning Parts for Plating
Anti-Corrosive Solution
New British Rust-Proofing
Magnetic Separator
Tinning Equipment
New British Oxidizing Process

Associations and Societies..... 126

Personals 127

Deaths 128

News of the Industry..... 128

Review of the Wrought Metal Business..... 134

Metal Market Review..... 135

Metal Prices 136

Supply Prices 138

EDITORIAL

INSTITUTE OF METALS DIVISION

The 1924 meeting of the Institute of Metals Division in New York brought up some topics of unusual interest and value, not only to the members but to the metal industries as a whole.

The Annual Lecture was given this year by Dr. Zay Jeffries of Cleveland on The Trend in the Science of Metals. It is now admitted by everyone that the Annual Lecture is a fixture of great value. It is attended not only by members of the Division but by even a larger number of other members of the Institute. The papers read were of uniformly high grade and elicited, in some cases, warm discussion. Those of particular interest were Some Low Copper Nickel Silvers, by Price and Grant; and the Corrosion of Brass as Affected by Grain Size, by Anderson and Enos.

One whole session was given over to a round table discussion on fluxes and de-oxidizers. Since no preprinted papers were read and discussions were not to be public, the utmost freedom prevailed, and the vexing problem was discussed from every angle. It seems a pity, to be sure, that it is impossible for people to talk as freely for publication as they do in closed session, but that is something a little too deeply rooted in human nature to waste much time worrying about. It is regrettable that only those who could be present benefitted directly by the discussion, but eventually, of course, results of these "talks" will be put down in the form of conclusions and published.

Another point of interest to metallurgists is the fact that the Institute of Metals Division has put itself definitely on record as being satisfied with its present affiliation with the American Institute of Mining Engineers. This decision is to be commended. The home given to the Division is a comfortable one and the Division gets its full share of attention in spite of the fact that it is numerically small. Moreover, it will undoubtedly result in the concentration of energy on the production of papers rather than in the turmoil of reorganization. The financial status of the Division is good and the membership list healthy. The status of the Institute of Metals Division can be summed up in the word "progress."

RESEARCH IN COPPER AND BRASS

A recent article by W. H. Bassett, Technical Superintendent of the American Brass Company, published in Mining and Metallurgy, for February, 1924, brings out very clearly a point of view which is strangely hard for the average foundryman or rolling mill man to understand. Mr. Bassett speaks of the value of research in the work of metals. He shows first of all that the researches carried on by a group consisting of a copper refiner, a rolling mill man and a manufacturer of electrical machinery, resulted in standardizing specifications for copper so that purchasers now know they are receiving a product which will stand up under the work to which it has to be subjected. Chemical analysis, metallographic examination, physical tests, and electrical tests were carried on with wire bars and cakes. Two hundred carloads of ingots were made into eyelet brass, the alloy rolled and results carefully recorded and checked against previous analyses of each carload of metal. It was found that copper having a purity of 99.9 (silver being counted as copper), and conductivity of 98.5 per cent would be satisfactory for all purposes required.

Other researches have resulted in making good zinc from poor ore and has added Butte, Montana, to the nation's zinc producing districts; electric furnaces have resulted in saving metallurgical losses, labor and fuel and added to the comfort of the workers.

Mr. Bassett writes of the importance of the microscope, an instrument once not even permitted in the large plants of the country and at the present time sneered at by many "practical" men. The use of the microscope began as an experiment, to see what it was good for, and with the help of perfected polishing and etching methods, it showed very clearly that the effects of cold working, such as rolling, drawing or forging could be detected in the change of shape in the grain or crystal. Effects of handling can be discerned and in this way rolling mill operations can be standardized and uniform metal produced. The heat treatment of copper and brass is no longer a matter of guess-work by appearance or color. It is now handled by pyrometric control. Wood for fuel has given way to oil or electricity. Cracking in brass can be traced to its cause and numerous operations dropped because sheet metal can be heated to a pre-determined, accurate grain size, thus eliminating the need for certain steps in working.

Instances could be multiplied but are unnecessary. The point is that the copper producing industry and the brass manufacturing industry have reached their present high stage of development because of research with the pyrometer, microscope and chemical laboratory, and are now going much further with the spectroscope and the X-ray equipment. Only those hopelessly old-fashioned and utterly blind to progress can claim that these things are "mere theory" and "useless in practice."

INSTITUTE OF ELECTRO-PLATING

At the annual meeting of the New York Branch of the American Electro-Platers' Society on February 23, 1924, Charles H. Proctor, founder of the Society and plating-chemical editor of THE METAL INDUSTRY, opened a topic for discussion which is sure to go far in the near future. Mr. Proctor recommended that an Institute of Electroplating be founded. This institute was to serve, not especially as a body to distribute information in the form of technical papers as most institutes do today. That work is being done satisfactorily by the American Electro-Platers' Society. The Institute is to act as a central in-

formation bureau with files or records showing work done in electro-plating. These files are to be accessible to all members, and any information is to be theirs for the asking. In addition, a research department is to be supported which will work on problems brought up and recommended by the members. To be sure, the Bureau of Standards is doing work along these lines today but it has a great many other problems to deal with, and cannot devote the concentrated attention to plating problems which such an institution would, if properly supported.

This is no small project. The idea, of course, has been tried elsewhere, particular cases in point being several British research associations and the work done by the malleable castings manufacturers in this country. There is no question about the value of such an institute. The whole problem becomes one of finance.

At the meeting, Mr. Gehling of Philadelphia, announced that his branch had taken up this idea seriously and were considering the project along the lines of making it self-supporting by means of job-work. Although this plan is perhaps feasible, it offers a great many difficulties and will find obstacles far from small in its way. In the first place it will be difficult to get sufficient work to pay a large enough profit to support an efficient research staff properly. In the second place if sufficient work is gathered, it might interfere seriously with other job shops in the district and become highly unpopular for that reason. Mr. Gehling estimated that a cost of a research laboratory would be from $10,000 to $15,000 per year. It is commonly known that it takes a fairly respectable little job shop to earn $10,000 to $15,000 per year, in addition to a reasonable salary for the operator.

This is not intended to discourage the idea. We have no doubt that eventually it will be put into practice, whether along the lines advocated by Mr. Gehling, or by popular subscription, or otherwise. The point is that in attempting such a venture, the American Electro-Platers' Society should (and no doubt will) be the leaders in exercising extreme caution, and proceeding only one step at a time. It is a tremendous undertaking and full credit will go to Mr. Proctor, the American Electro-Platers' Society and everybody else interested in it.

HOT ZINC COATING

The letter from the Hanlon-Gregory Galvanizing Company, published in this issue, is of great interest to the zinc using and producing industry in that it explains the viewpoint of the zinc consumer who is directly responsible to the public. According to this company, if the zinc is put on properly, it should have a coating of from 2 to 2½ ozs. per square foot. Less than this figure can be put on, but it would have to be done by special methods such as "squeezing" or "skinning." It is stated that in job galvanizing plants it is impossible for this to go on because of the diverse sizes and shapes handled which make it impossible to utilize a standard fixture to remove any part of the zinc coating.

Mr. Gregory recommends, among other things, the advertised standard of from 2 to 2½ ozs. per square foot and a stamp on all sheets which are up to this standard. It is generally agreed, of course, that publicity is a good cure for most trade evils. It seems reasonable to assume that if this or any other standard were taken and sheets stamped, showing that they have passed the necessary tests, all concerns which did not bring their product up to the standard, and could not for this reason stamp their products in this fashion, would find it much more difficult to sell a "skinned" product at a full price.

This is particularly applicable to corrugated iron sheeting for the reason that this work is done, not in job plants, but in plants which make a specialty of that one product, and are, therefore, in an excellent position to "squeeze" or "skin" the zinc if they so desire.

The American Zinc Institute, under the direction of Stephen S. Tuthill, Secretary, has in project the elimination of such practices by an organized campaign. We can only say that such a campaign will have the moral support, and in the end obtain the financial support, of every reputable metal manufacturer and user.

VALUE OF SILVER

In these troubled times when everybody works with one eye on his factory and another on the market prices of raw materials, it is pleasant to know that in some cases, at least, value consists not of a speculative market price but of real utility and beauty placed on an object by an expert and artist. A short time ago in a sale of antique and modern objects of art at the American Art Galleries of New York, a silver presentation bowl made by Paul Revere (of Paul Revere's Ride fame) sold for $4,200. It is probable, of course, that historic interest played some part in this price, but it is more likely that all but a little of this figure consisted of real value in the beauty and workmanship of the piece. The question of the Pittman Act or the consumption of silver in China played no part whatsoever.

We have a feeling, general to be sure, that no price is too high to pay for good workmanship, whether that workmanship is done individually, by hand, or in the mass, by machines. It seems to us that the Paul Revere bowl should point the way for others, even though they are not making silver bowls. Quantity production is only one of the items to be considered. Others, which can hardly be overstressed, are quality of materials and character of workmanship. If these things are taken care of, the value in the long run will look after itself.

GOVERNMENT PUBLICATIONS

Coal in 1919, 1920 and 1921, by F. G. Tryon and Sydney A. Hale, U. S. Geological Survey, Washington, D. C.

Commerce Year Book for 1922 Including the Early Part of 1923, U. S. Department of Commerce, Washington, D. C. This volume contains a general review for the year 1922 and early months of 1923 followed by reviews of separate industries.

Annual Report of the Secretary of Commerce for 1923. This report covers general economic situation during the fiscal year; administrative work of the department; investigations into various economic problems; legislation needed.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

ABUSES IN ZINCING

To the Editor of THE METAL INDUSTRY:

We have your letter of February 7 calling to our attention the article appearing in the January issue of THE METAL INDUSTRY, pertaining to the uses of zinc and the abuses of galvanizing, written by Mr. S. S. Tuthill, secretary of the American Zinc Institute.

We appreciate the honor of being asked to comment on Mr. Tuthill's statements and are pleased, moreover, particularly from a job galvanizer's point of view, to do so.

Zinc is unquestionably the prime protective agency for iron and steel against corrosion, and, of course since it is the zinc which resists attack by the elements, the life of the material coated depends entirely on the method of applying the coating and the quantity of the coating applied. In other words—the ultimate usefulness or life of galvanized (zinc coated) iron or steel is directly proportional to the quantity and to the quality of the zinc coating and the method by which it is applied. The thinner the zinc coating, the shorter consequently will be the life of the coated material.

Our experience proves that the best method of applying zinc coating is by what is known as the "Hot Dip Process." The product or material to be galvanized is first made ready by dipping it in an acid solution to cleanse it from scale and foreign matter. It is then washed and dried thoroughly, again dipped in acid and, when thus prepared, it is ready for immersion in a bath of molten zinc. The product or material remains in this bath until it acquires the same temperature as the molten zinc. It is then withdrawn, and if no mechanical means whatever are employed to remove any of the zinc coating, it will have a surface of from 2 to 2½ ounces of zinc per square foot—the best protective coating obtainable.

Mr. Tuthill does not mention in his article any particular product on which the present-day coating is as low as 1¼ ounces per square foot. We believe, however, that we know the products to which he refers, but, the public does not know and is therefore led to understand that this practice of so-called "squeezing and skinning" applies to all galvanizing as done today. In the average job galvanizing plant (particularly where the Hot Dip Process is applied) there is usually such a variety of products galvanized that the "squeezing" and "skinning" methods cannot exist. Due to the diverse sizes and shapes alone, it is impossible to utilize an appliance that will remove any of the zinc coating that adheres when "hot dipped."

Hundreds of millions of dollars are lost annually in this country from the rusting of iron and steel. A large percentage of this loss could, undoubtedly, be saved by zinc coating or "hot dip" galvanizing. During the World War, the United States Government advised conservatism and wherever it was possible iron and steel were zinc coated to preserve their usefulness. Since the war, consequently, there has been more galvanizing done than ever before, but not until a more conscientious coating of zinc is applied to the one or two products to which Mr. Tuthill alludes, may we reasonably anticipate a lessening of the tremendous waste that still exists. It is indeed regrettable that the efficiency of zinc as a protective coating should be judged by the insufficient zinc coating which is applied to one or two products by manufacturers who admit of their "squeezing" and "skinning" methods.

The public does not know clearly or comprehensibly just what galvanizing or zinc coating really is, nor is it familiar with the different products that could and should be galvanized and thereby economically made to last longer.

We sincerely believe that much good can be accomplished for the zinc and galvanizing industries by educating the public to the unquestioned economic need for galvanizing as a "life extension agency" for iron and steel products and materials. A co-operative advertising campaign, properly planned and consistently employed, will help enormously to conserve the hundreds of millions of dollars now literally sacrificed to rust and corrosion. Then, too, we believe that an educational publicity campaign based on facts, figures, comparisons, and the truth can undoubtedly replace the lack of confidence resultant from "squeezed" and "skinned" galvanizing.

Does it not seem reasonable that by joining forces for mutual trade expansion and accomplishment, both zinc manufacturers and job galvanizers can increase the demand for their inter-dependent service to industry and mankind? An advertised standard of 2 to 2½ ounces of zinc coating per square foot of "hot dipped" galvanized surface stamped on every galvanized product in the form of a seal or association trade mark would go a long, long way to create considerable consumer confidence, and at the same time force dissenting few to acknowledge the necessity for fair dealing.

Hanlon-Gregory Galvanizing Company
THOS. M. GREGORY
Vice-President and General Manager.

Pittsburgh, Pa., February 27, 1924.

LIFE OF CRUCIBLES

To the Editor of THE METAL INDUSTRY:

Referring to the recent statements about the life of crucibles some time ago I made some tests with M. R. V. furnaces using the English Waterhouse crucibles. I got 77 heats per crucible but I was beaten to a standstill by a Philadelphia concern that had a record of 135 heats with the same make of crucible.

A great deal depends, of course, upon the type of furnace used and that is why figures which do not specify the furnace are hard to judge. Pots once put into service should never be in a temperature less than 212° F. until they are used up.

I agree with Jonathan Bartley in his statement in the February issue of THE METAL INDUSTRY that crucibles should go from 30 to 40 heats at least, but I must say that present day pots, under the conditions in which they are used, do not give these results.—BRASSMAN

New Books

Principles of Electro-Plating and Electro-Forming. (Electrotyping). By Dr. W. Blum and G. B. Hogaboom.

Published by McGraw-Hill Book Company. Size 6 x 9. 356 pages. Price, payable in advance, $4.00. For sale by THE METAL INDUSTRY.

This book is one for which the plating industries have been waiting. It is the result of collaboration between a chemist and a practical plater, both of whom are nationally known. The authors have been associated with the investigation of electro-typing and electro-plating processes at the Bureau of Standards, and have worked in close co-operation with the American Electro-Platers' Society and the International Association of Electrotypers. The book has been prepared, not so much for the purpose of presenting results of research as of assisting those in the industry to apply the results that have been or may be secured in various research and educational institutions.

Subjects covered by the book are as follows:

1. Theoretical Aspects of Plating, including the principles of chemistry, the methods of expressing conditions of operation, such as temperature, density and composition.
2. Elementary Principles of Chemical Analysis.
3. Principles of Electricity.
4. Principles of Electro-chemistry.
5. Factors Governing Character of Deposits, such as current density, concentration, temperature, conductivity, etc.

6. Selection, Specification and Inspection of Electro-Deposits.

The rest of the book is devoted to the practical aspects of plating and gives not only general methods, but details, such as formulæ for solutions, recommendations for equipment, both electrical and non-electrical, a description of the methods and chemicals used in cleaning and preparing the work for a metallic coating. Solutions described include the following: copper, nickel, cobalt, iron, zinc, cadmium, lead, tin, silver, gold, platinum, and alloys such as lead-tin, brass, etc.

A number of valuable tables are appended and descriptions of typical experiments to teach the reader how to carry on investigations of his own.

It is useless to waste space on superfluous praise. The authors are too well known to need introductions or biographies. It is obvious that this book should be in the hands of every plater and electro-chemist.

Industrial Management. By R. H. Lansburgh. Published by John Wiley & Sons, New York. Size 6 x 9—488 pages. Price, payable in advance $4.50. For sale by THE METAL INDUSTRY.

This is a book on a subject which, although it has claimed considerable attention from the public and the engineering profession, has up to this time not been completely covered by one work. Industrial Management is designed to cover the entire topic of factory control and manufacturing, and to be not only a reference work but a textbook.

On a subject so diverse, so variable and covering such a wide range, it is necessary that a book, in order to be useful, should deal largely with fundamentals, which this book does. However, it includes examples and illustrations from a diverse group of industries in order to illustrate and clarify the broad principles laid down.

The general subjects covered are Plant Organization; Physical Side of the Plant, (including location, layout, lighting, air conditioning and power); Standardization of Product and Operations (and the maintaining of these standards); Job Study (including time studies); Wage Payment and Incentive Wage Systems; Personnel Relations (covering employment and employee participation in management); Controlling Operations (such as budgeting control of inventories); Purchasing Department; Sales; Routing; Costs.

No factory executive or anyone aspiring to be a factory executive should fail to examine this book.

Proceedings of the American Society for Testing Materials. Issued in two parts; Part I, 1006 pages; Part II, 683 pages. Price, payable in advance, for each Part, $6.00 in paper, $6.50 in cloth, $8.00 in ball-leather. For sale by THE METAL INDUSTRY.

Part I contains the annual reports of 32 of the standing committees of the Society, together with the discussion thereon at the annual meeting, and 103 tentative standards which have either been revised or are published for the first time; the annual address of the President and the annual Report of the Executive Committee.

Part II (683 pp.) contains 50 technical papers with discussion.

The technical papers contain valuable information on results of investigations by experts in the field of engineering materials and the reports of the committees cover Ferrous and Non-Ferrous Metals, Cement, Ceramics, Concrete, Gypsum, Lime, Preservative Coatings, Petroleum Products, Road Materials, Coal and Coke, Waterproofing Materials, Electrical Insulating Materials, Shipping Containers, Rubber Products, Textile Materials, Methods of Testing, and Nomenclature and Definitions.

Modern Electro-Plating. By W. E. Hughes (M. A. Cambridge, D.Sc., London). Published by the Oxford University Press, American Branch, New York. Size 6 x 9¼, 160 pages. Price, payable in advance, $5.35. For sale by THE METAL INDUSTRY.

This new book on electro-deposition of metals is more than a welcome addition to known literature upon the subject. The book is entirely different from previous works upon the subject and can be accepted by the electro chemist-metallurgist and electroplaters as a splendid work of reference. Instead of the usual rehashed treatise found in recent books on electro-plating, Mr. Hughes has written a book that can be considered as a standard work. American practice is predominant in the formulæ and data covering control of solutions, etc. There is, however, much that Mr. Hughes could have learned in America from a personal study of practical working results that is not incorporated in the book.

Topics covered are as follows: Theory of electro-deposition; Practice (preparation, deposition and finishing); Iron; Nickel; Zinc; Lead; Tin; Chromium; Copper; Structure of Electro-deposits. An unusually interesting and useful chapter on Reading is appended, giving reference works and periodicals on electro-plating.

TECHNICAL PAPERS

Methods for the Recovery of Platinum, Iridium, Palladium, Gold and Silver from Jewelers' Waste.—By C. W. Davis. Technical paper No. 342, Bureau of Mines, Washington, D. C.

Because of the extensive use of platinum and white gold in jewelry, the Bureau of Mines has prepared this paper in order to answer the numerous inquiries concerning the recovery of these metals from scrap, filings and sweeps. The manipulations and chemical procedures are given in an elementary fashion in order to enable persons with little laboratory experience to use them. It is stated, however, that the efficiency of the working of these methods depends upon the skill of the chemist or whoever else is in charge. A number of chemical, amalgamation and smelting methods are given and full details appended.

Testing. A monthly international journal devoted to the field of testing materials, structures, and machinery. This is a new journal published by the Pullman Publishing Company, Pullman Building, New York. It is intended to cover the field of testing of materials, and should prove very valuable to chemists, metallurgists and testing engineers. The first number includes material on Fatigue, Notched Bar Impact, Duralumin, Compression Testing, and Brinell Measurements.

Wet-Process Enamels for Cast Iron. By R. R. Danielson and H. P. Reinecker. Technologic Paper No. 246, Bureau of Standards, Washington, D. C.

Scope of investigation. This paper deals with an investigation of vitreous enamels to be applied to cast iron by the wet process, both with and without ground coats. About 130 different enamels have been applied to approximately 900 castings in this laboratory. Fifteen of the more promising compositions have been investigated further at a stove factory by a representative of the bureau, and in this work some 320 typical stove castings have been enameled. The effect of variations in the compositions of ground coats, white cover, enamels, and both colored and white single-coat enamels have been studied. Suitable technic for the preparation and application of the enamels is discussed.

CONCLUSIONS

Ground coats. Sintering of the ground coats is recommended to develop best adherence to the iron. Suitable mill batches consist of 100 parts of frit and 15 parts of clay, by weight or 10 parts each of clay and flint to 100 parts of frit.

White cover enamels. These may be smelted in the usual manner. Suitable mill batches are 100 parts frit, 8 of tin oxide and 5 of clay. The cover enamels must not be too refractory for the ground coat or blistering will result.

Single-coat colored enamels. Mill additions for these enamels are 4 per cent of clay and the necessary amounts of color oxides.

Single-coat while enamels. These are not as satisfactory in opacity as the white enamels applied over a ground coat. Mill additions must be low—4 per cent each of clay and tin oxide.

General. Boric oxide and cryolite tend to cause crawling of the enamels. Lead oxide promotes better adherence of enamels, although it decreases their firing range. Sodium oxide also decreases their firing range and causes blistering. Boric oxide increases firing range. Satisfactory compositions are given in the conclusions from the studies of the various types of enamels.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; R. E. SEARCH, Exchange-Research

BRAZING SOLDER

Q.—We occasionally purchase brazing spelter used in making joints on copper and brass pipe fittings. We have no detailed specification covering the chemical composition or physical properties of the spelter and we have received a fine grade almost in powder form on some orders while on others we have received coarser grades. Some of the spelter received has been too fine and others too coarse for our use.

We wish to adopt a specification on which to base future purchases that will properly define the grade best suited for our use. Will you kindly advise the trade or manufacturers' names for the different grades of spelter produced for such purpose, or let me have your suggestion on a specification that will define the metallic composition, permissible impurities and the coarseness of brazing spelter.

A.—Brazing solder is known to the trade in three grades—long grain, coarse and fine. It is composed of approximately:

55 to 60 copper
45 to 40 zinc
1/10% aluminum

The best grade is said to be 55% copper and 45% zinc, fluxed with 1/10% aluminum. The long grain is used for sheet and pipe work, also the coarse. The fine grain is used for steel.

For your work we would suggest a specification as above with not over 5% impurities. Use whatever grade your work requires, or gives the best results.—W. J. R. Problem 3,204.

CASTING LIGHTING FIXTURES

Q.—We had a foundry installed in our plant and are in the lighting fixture business in a sort of a production way, and we are somewhat up against it in being able to get good castings. We have tried to make mixtures of different kinds and have also used yellow metal scraps but up to this time have not had results with the castings coming out with good details. A great many times they will not run out and the metal seems to be hot. We have been using some small pieces of phosphor copper in our metal as we had been advised but it seems to more or less harden the metal and seems to cause the metal to stick very hard. We have also used aluminum but it makes the metal brittle and difficult to braze.

As our castings are entirely lighting fixture in light brass or rather a dip metal, we think that a metal that will run out light but still keep sharp details is what we require. Light ornaments also require a good detail as you know they must show up well. Should the moulds be baked?

We made an inquiry some time ago with a metal company, Michigan Smelting & Refining Co., they informed us to use virgin copper and zinc about 65% and 35% without any lead. From the above inquiry we understand that it is not advisable to use lead as it will not make a bright color.

A.—A mixture that we would suggest for your class of work, where brazing work is done in connection with the castings, is:

Copper	70.5%
Zinc	25.5
Lead	2.0
Tin	1.0

This mixture will dip very nicely and run smooth.

However, the molding has a lot to do with the success of casting such a mixture. A fine grade of sand should be used and for very thin chandelier work we would suggest the mold be skin and dried. For a facing sand use one part of new No. 1 Albany sand and 6 parts of old sand, sieve through a No. 40 mesh riddle and temper to suit with the water. To the water add 6 ozs. of salt and skin-dry the mold. For green sand molding, use the sand as dry as consistent for drawing the pattern from the mold.

Do not pour too hot, but keep the gates filled. It is better that you spill a little metal, rather than not keep the gate full.—W. J. R. Problem 3,205.

DROSSY BABBITT

Q.—For ordinary babbitt bearings we use what is classed as junk babbitt, and which is composed of miscellaneous bearings, including discarded bearings from automobiles and similar machines. We find the metal quite satisfactory for the use we make of it but in casting the bearings there is always considerable dross or skimmings on the metal and this, of course, produces scabby places in the bearings.

It occurs to us that we should be able to get a flux of some kind to use with this metal which will prevent this trouble. We have used rosin but it seems that the pouring temperature of the metal is rather too high for rosin. If you can give us a satisfactory flux or outline a method for treating this character of metal to prevent the scaly surface on the bearings, we shall be glad to have it either direct or through your columns.

A.—In using this class of material, the thing you should guard against is zinc, as zinc will cause babbitt metal to dross and run dirty and take all the life from the metal.

Granting that you eliminate the zinc, the method to use to refine your metal is to melt in an iron pot and boil the metal by inserting a piece of green wood or raw potato, and if your metal contains any zinc, add a small shovel of oxide of lead called litharge, and boil. Skim off the metal and flux with a handful of sal ammoniac and rosin mixed. Your metal should be free from dross and prevent the scaly surface.—W. J. R. Problem 3,206.

ENGRAVING ON BRASS

Q.—Can you refer me to any article or furnish me information as to how engraved letters on brass or nickel finished novelties are finished in colors. (black, green, etc.)? For instance I would like to know how letters engraved or stamped on brass could be finished in black after the name has been stamped and the brass polished. We have been using "Drop Black Ground" in japan mixed with turpentine, applying with a rag or brush, then allowing to dry a few minutes before rubbing same off. This method has not been entirely satisfactory due to the fact that it is very slow and tedious. Then too, in wiping off, the black in the letters also seems to pull out. Then when it is lacquered the black has a tendency to mix with the lacquer, which gives a poor finish.

A.—We believe your problem can readily be solved as follows:

1. Your products should be lacquered after the usual polishing and cleaning, and allowed to become thoroughly dry.
2. Procure some good japan colors in the colors desired.
3. Apply the colors with felt or brush to the articles. The color will not penetrate the lacquer, so the excess can be readily removed with rags, slightly moistened with a mixture of equal parts of turpentine and linseed oil.
4. Some firms use silicate paints. Such paints can be prepared with dry colors. They dry hard and the excess can be removed with a rag moistened with water. Sodium silicate is commonly termed water glass. It is used as the basis for the so-termed cold water paints. Always lacquer your metal surface before applying any colors of the above varieties.—C. H. P. Problem 3,207.

GOLD ON DENTAL PLATES

Q. Being a reader of THE METAL INDUSTRY, I would like to know if you could give me any information on plating rubber dental plates in gold or silver. I tried different methods but had no success in making it stick to the rubber. Inclosed you will find a sample piece in which I refer to.

A.—We suggest that you try the following method in plating dental plates with gold or silver.

1. Soften the rubber plate with a solvent such as benzine or tetrachloride of carbon, then while just tacky, apply what is termed silver lining bronze powder. This powder may be either of finely divided tin or silver.

When the surface is thoroughly dry, plate in a fairly concentrated silver cyanide solution about 6 ozs. of metal per gallon; the free cyanide to be kept as low as consistent with a good deposit.

2. After a fairly good coat of silver is produced, it will not be difficult to produce a gold deposit of any thickness. It is advisable to use a gold solution containing not less than 1 oz. of fine gold per gallon of solution—temperature not to exceed 80° F.

If the rubber plate does not soften under the influence of benzine or tetrachloride of carbon, then it is advisable to apply a very thin coat of rubber cement and while tacky, apply the lining bronze powder.—C. H. P. Problem 3,208.

GREEN SCUM ON NICKEL

Q.—I have in charge two nickel plating tanks of 400 gallon capacity. In one of these tanks the solution is giving considerable trouble due to a thick green scum which appears on the surface every morning and the plating work is frequently heavily pitted with feather edges. In some instances the work appears to be good but will peel off under the buff and is not as bright as work taken from the other tank.

The pH of both solutions are similar and the litmus paper test shows the acidity of both solutions about the same. The solutions in both tanks were built up with single and double nickel salts but the tank referred to has been used for experimental purposes and it is my opinion that some chemical may have been added, and I am unable to overcome this effect.

A.—The sample of the substance submitted is too small for analysis. We should say it is nickel hydrate mixed with iron. Although the pH determination of both solutions would indicate that the acidity is identical, yet such indications cannot determine the difficulty that develops in a nickel solution when it goes wrong.

Only a complete analysis would determine this point. Not knowing this, we can only suggest a possible remedy. The inference is that the conductivity and the acidity is low for this particular solution.

Add 2 ozs. ammonium chloride per gallon of solution first. Follow up with ¼ oz. of pure muriatic acid per gallon, increasing to ½ oz. if necessary to correct the present condition. We believe these additions will overcome the trouble.—C. H. P. Problem 3,209.

IMITATION PLATINUM AND WHITE GOLD

Q.—Please give me a formula for imitation platinum or white gold.

A.—Imitation of platinum and white gold is usually produced in a dilute warm nickel solution, or one of tin. We give you two formulæ that may answer your purpose:

Nickel

Water	1 gallon
Double Nickel Salts	2 ozs.
Single Nickel Salts	1 oz.
Boracic Acid	¼ oz.
Sal Ammoniac	¼ oz.
Cadmium Chloride or Sulphate	1 to 5 grains.

Possibly a minute amount of tin chloride will be of value; 1/16 oz. will be ample.

Try this solution—from 80° F. upwards.

Tin

Water	1 gallon
Pyrophosphate of Soda	1½ oz.
Tin Chloride	½ oz.
Glue previously dissolved in hot water	1/64 oz.

Heat the solution to 180° F. Use tin anodes. Voltage 3 to 4. Only a flash is necessary unless scratch brushing is to follow. —C. H. P. Problem 3,210.

MELTING FURNACE INSTALLATION

Q.—I am constructing a small coke furnace for melting metals. It is to be used indoors. One centrifugal blower will supply the draft, a second exhaust blower will collect spent gases from above the furnace and blow them out through a pipe into the open air.

What suggestions or cautions would you give us? Are the dangers from gas great enough to make such a system unsafe?

A.—In our opinion you can construct your furnace as you describe without any great danger from gas. If your building is so arranged that you can run an iron stack through the roof and if you build an iron hood over the furnace, this would carry off the smoke and fumes from the furnace. It is, however, a common practice to operate the furnaces without the hood, allowing the smoke and fumes to pass out through the ventilator. Many places have exhaust fans, to keep the atmosphere clear from smoke and fumes.—W. J. R. Problem 3,211.

NICKEL SOLUTION

Q.—We wish to ask you a question in regard to our nickel solution. Our tank is 84"x28"x20", one work rod, two anode rods each anode rod carrying six 8"x12" anodes. Have we enough anodes in this tank to do good work, or would it be advisable to put two work rods in same tank and three anode rods so as to have a larger anode surface?

The deposit seems very thin now although we run our work 2 hours and has a fairly white deposit; the solution stands a 6½° Baume. At times, when it peels, the nickel seems to be very brittle.

Please give me the formula for nickel solution using single nickel salts and carbonate of ammonia, instead of double salts.

A.—In our opinion the distance between the anode and cathode rods is too great for satisfactory rapid nickel deposit, unless you have a very conductive solution with considerable metal in solution. We would advise 3 anode rods with 2 work rods using an additional 6 anodes in the third rod or better still, use 8 or 9 anodes on each anode rod.

The brittleness of your nickel deposit is possibly due to a low temperature solution. The temperature should not go below 70° F —better 80° F. Use a lead steam coil, if necessary, to maintain an equal temperature.

The addition of 2 ozs. single nickel salts, 2 ozs. sal ammoniac and ¼ oz. pure muriatic acid per gallon of solution will improve it—especially if you change the conditions as outlined.

The most satisfactory formula for your purpose is as follows:

Water	1 gal.
Single Nickel Salts	12 ozs.
Boracic Acid	3 ozs.
Sal Ammoniac	2 ozs.
Epsom Salts	2 ozs.

C. H. P. Problem 3,212.

NICKEL VOLTITE

Q.—I am wondering if you are in position to furnish us with some Nickel Voltite. The writer knows that at one time there was some of this material. We have occasion here at times to use something of this sort.

A.—We are not in a position to furnish you with Voltite nickel plating powders. The formula was disposed of to the Universal Plating Powder Materials Corporation, Glen Cliff, L. I., N. Y. We would suggest that you correspond with the above firm. They may be in a position to furnish you with the material. If these people cannot supply you, advise us. We may be able to give you the formula to make up the material required.—C. H. P. Problem 3,213.

SILVER PLATING OVER HOLES

Q.—Can fine holes in steel pie server blades be given a heavy silver plate burnished by hand and not show?

A.—Electro deposits of any metal will not bridge a hole of the minutest description. The deposit builds around it. It is however possible to stretch as it were, a very soft deposit of silver or copper by the pressure of the burnishing tool, so that the deposit will stretch or bridge the minute pinholes, especially if the burnishing is accomplished from both sides of the pinhole and directly towards its centre.

If the articles are then given a light plate following the burnishing operation, the deposit will entirely cover the bridge so built up and produce a continuous deposit.—C. H. P. Problem 3,214.

PATENTS

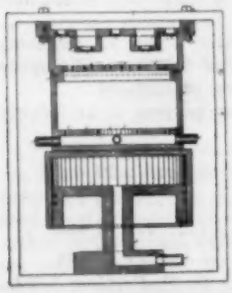
A REVIEW OF CURRENT PATENTS OF INTEREST

1,480,212. January 8, 1924. **Process of Manufacture of Ingots of Pure Nickel from Impure Oxides of Nickel.** Jacques de Fonds Lamothe, Paris, France.

The improved process for the manufacture of ingots of pure nickel from impure oxide of nickel; the said process comprising effecting the partial reduction of impure and pulverized oxide of nickel by means of a suitable reducing agent intimately mixed with the oxide; then levigating the powdered nickel when partly reduced, using weak solutions of hydrochloric and hydrofluoric acids.

1,480,267. January 8, 1924. **Process for the Manufacture of Manganese or of Manganese Alloys Poor in Carbon and Silicon.** Bo Michael Sture Kalling and Sven Dagobert Danieli, Trollhattan, Sweden, assignors to Aktiebolaget Ferrolegeringar, Stockholm, Sweden.

The process of manufacturing manganese poor in carbon and silicon, and having low percentages of phosphorus and iron, which consists in smelting manganese ores in which the principal content of manganese occurs in the form of manganese oxides having an average degree of oxidation of the manganese higher than is represented by the formula MnO in an electric furnace with a quantity of reduction-carbon adapted to reduce the main part of the higher manganese oxides of the ore into manganous oxide, a part of the eventually occurring iron oxides to iron and a part of the eventually occurring phosphoric combinations to phosphorus.

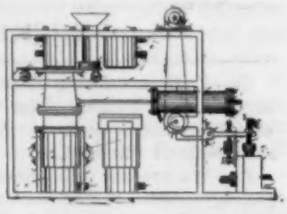


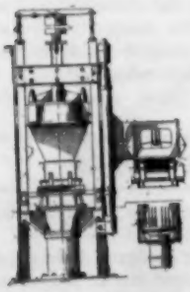
1,480,748. January 15, 1924. **Molding Apparatus.** Henry L. Demmler, Kewanee, Ill.

The combination of a flask provided at one end with a plate having openings for the admission of sand and air, and a closure plate for the other end of the flask having openings adapted to permit the escape of air and prevent the escape of sand.

1,480,749. January 15, 1924. **Molding Machine.** Henry L. Demmler, Kewanee, Ill.

In a molding machine, the combination of a sand container, means for compacting sand in the container, and means for securing a mold form to the container, and means for forcing sand from the container into the form by gaseous fluid pressure.



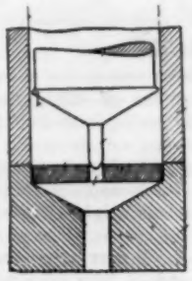


1,480,750. January 15, 1924. **Method of and Machine for Making Molds.** Henry L. Demmler, Kewanee, Ill.

In a molding machine, the combination of a sand container having an outlet, means for securing a mold form to the container in register with the outlet, means for jolting the container, and means for supplying gaseous fluid pressure to the container to force sand into the form.

1,481,338. January 22, 1924. **Annealing Furnace.** Chauncey C. Baldwin, Perth Amboy, N. J., assignor to Standard Underground Cable Company, Perth Amboy, N. J.

An annealing furnace comprising a tank with cantilever retort-seat at one end and a loading-floor at the other, the said seat having an inverted retort seated thereon with an aperture below the same for inserting the load in the retort, a platform fitted to enter the bottom of the retort with its load, and a traveling crane with connections for raising and lowering the platform below the retort and for depositing the platform with its load upon the loading-floor.



1,480,843. January 15, 1924. Method **for the Cold Spurting of Tubes and Thin-Walled Metal Pipes of Lead, Tin and Especially Aluminum.** Fritz Singer, Nuremberg, Germany, assignor to Fritz Neumeyer A-G., Nuremberg, Bavaria, Germany.

Method for the production of compressible tubes and other thin-walled tubes of lead, tin and especially aluminum consisting in molding the tubes from square blanks by the cold extrusion process.

1,480,869. January 15, 1924. **Method of Coloring Magnesium and Magnesium Alloys by Etching.** Felix Thomas, Frankfort-on-the-Main, Germany, assignor to the Firm Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

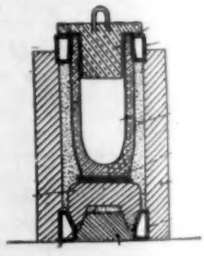
The method of coloring magnesium and magnesium alloys by etching, which comprises the simultaneous treatment of said metal with chromic acid and a solution of a salt of a heavy metal.

1,480,870. January 15, 1924. **Method for Rolling Magnesium Alloys.** Felix Thomas, Frankfort-on-the-Main, Germany, assignor to the Firm Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

The method of rolling magnesium-zinc alloys which comprises submitting the alloy to be rolled to heat in such a way that its temperature right through is 220-250° C. and thereupon rolling said heated alloy at said temperature.

1,481,228. January 15, 1924. **Electric Furnace.** Tito Rondelli, London, England.

In an electric resistance furnace comprising a main resistant body providing the furnace chamber or crucible; a member of large size made of a material of the same character as said main resistant body for feeding the current to said body, said member being provided with a recess on its side opposed to its face adjacent to said main resistant body, refractory material located in said recess, a layer of high resistance material located between said member and the facing portion of said main resistant body and conductors contacting with the peripheral surface of said member and connected with a pole of a current supply.



1,481,782. January 22, 1924. **Alloy for Turbine Blades.** Ityro Iytaka, Sugamoachi, Japan.

An alloy for turbine blades, including copper as the main constituent, and subordinate constituents consisting of 5 to 7% of aluminum, 3 to 8% of nickel, and 1 to 3% of iron, and further characterized by the proportions of 90 to 96% of copper plus aluminum, 4 to 10% of nickel plus iron and accordingly 10 to 14% of nickel plus aluminum, substantially as set forth.

15,754. Reissued. February 5, 1924. **Conveying Mechanism.** Floyd T. Taylor, Matawan, N. J., assignor to A. P. Munning & Company, Newark, N. J.

A conveying mechanism having a plurality of independent movable conveyors adapted to transport material in different receptacles, and mechanism operable independently for intermittently transferring the material from one conveyer to another.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

REBUILDING BY ELECTRO-DEPOSITION

According to a statement from Fescol, Limited, of Penarth street, Canterbury Road, Old Kent Road, London, S. E. 15, England, by the Fescol process, nickel or copper is deposited upon iron and its alloys, copper and its alloys, aluminum and its alloys, to almost any desired thickness, in such a manner that machine parts, which have fallen below standard size through wear and erosion, or have been machined in error, may be quite safely made good by this method, and the process has been adopted as standard by a large number of the great establishments of England. The use of copper or nickel as a protective measure, applied to iron or steel and aluminium, will permit of these metals being used for purposes which hitherto have been impossible. Fittings Fescolized in nickel require, it is claimed, very little cleaning, even when exposed to atmospheric conditions; this applies particularly to railway, ship's, public vehicular and other fittings, thus effecting a great saving in cleaning expenses, besides avoiding destruction by erosion and corrosion with the consequent loss.

It is stated that unstrippable nickel, copper, etc., can be deposited, but not iron, as at present it is not a commercial proposition. Steel (case-hardened parts), iron (cast or malleable), phosphor-bronze and brass are among the materials that can be used.

The Fescol process is a cold one and does not distort nor affect the part. The deposit is said to be rustless, machinable and unstrippable; metal can be deposited up to ½ in. in depth, although at this depth, at present, it is not usually a commercial proposition. Some parts (shielded and interiors) cannot take such heavy deposits as others and are slower in process. Broken parts cannot be united. The process can be used as a preventive against erosion or corrosion caused by atmospheric action or the action of water, and especially sea water.

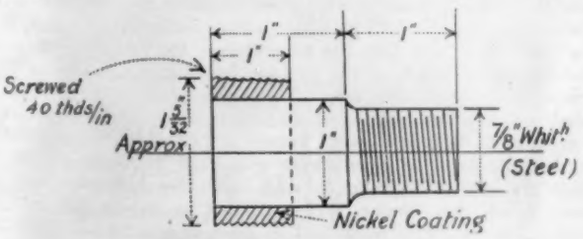
Reports state that up to the present attempts to remove the deposit have given only two results: the base or part on which the deposit is installed has sheared, or to get rid of the deposit, a machining operation has been necessary, which reduces the original size of the part as the deposit interlocks and becomes an integral part of the original.

Pistons having .004" deposited have only shown .002" wear after 20,000 miles in 15 months. Stub axles, after 4,000 miles, showed only .003" wear; crankshafts have run for 12 months and done over 15,000 miles before being again Fescolized, and the maximum wear was .011", with a minimum of .004".

An advantage claimed for the process is that any new part made minus .001" to .005" all over, and the deficiency made good by Fescolizing the part, will resist any atmospheric conditions in any same time give an ideal wearing or bearing surface always ready climate, remaining bright in store without attention, and at the for duty when required.

ADHESION TEST

This test was carried out at the National Physical Laboratory in order to determine the adhesion of the coating to steel. A test piece was supplied and machined to the form given in following sketch:



TEST PIECE FOR ADHESION

The length of the coating was one inch as supplied. A testing machine holder was screwed on to the nickel and another on the ⅞-in. steel plug. The test piece was then inserted in the testing machine and an increasing load applied.

No breaking down of the adhesion of the nickel was found under a load of ten tons.

Part of the nickel coating was then cut away, leaving a length of 0.215 inch; under these conditions the coating was pulled off of the steel with a load of 11.95 tons.*

RESULTS

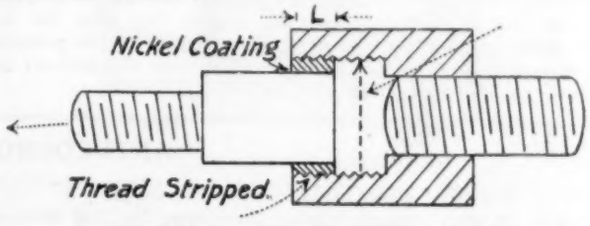
NPL. Eng. Dept. Test Marks	Area of Adhesion square inches	Breaking Load tons	Breaking Load, tons per sq. in. of adhesion surface
AFW1	0.675	11.95	17.6

February 3, 1921.

Ref. Eng. Dept., AFW/RGB.
HWA.

T. E. STANTON,
pp. Director.

DEAR SIR:—As requested at your visit to the laboratory, we have pleasure in giving below the further information you desire with reference to the adhesion test on the nickel-coated specimens which you supplied. A thread of 40 per inch was turned on the nickel coating. This was screwed into a steel holder as illustrated in the following sketch:



TEST PIECE FOR THREAD CUT IN DEPOSIT

With a length of thread (L) = 0.215 inches, the thread of the steel holder stripped with a load of 6.74 tons, leaving the thread on the nickel intact. The average Scleroscope hardness number of the steel holder was 28.

Trusting this information will satisfy your requirements.

Yours faithfully,
T. E. STANTON,
Superintendent.

*It should be noted the test pieces show the steel sheared; and again there was no breaking down of the adhesion.—N-S. Fescol.

MICROSCOPIC SECTION X250

In another letter the N. P. L. state that the average Scleroscope hardness number of nickel electro-deposited by the Fescol process is 60.

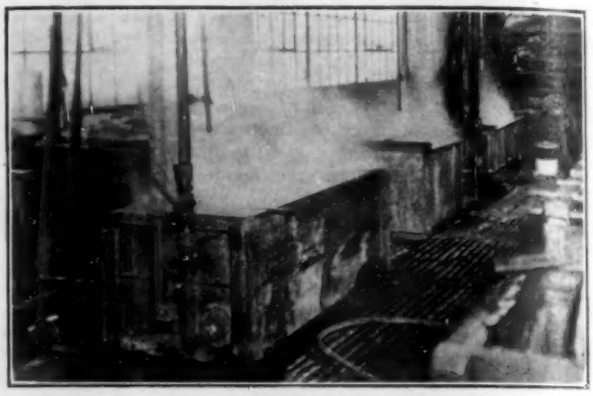
SOME PARTS ALREADY TREATED

Gun parts, scientific instruments, surgical instruments, dental instruments, head lamps, golf clubs, film machine parts, mincing machines, name plates, film guides, die cases and arms, steel rules, engineering instruments, telephone fillers, Ford car parts, telephone apparati, kitchen lifters, cast iron plates, door handles, accumulator cases or boxes, electric light fittings, gas fires, motor boats, aeroplane parts.

CLEANING PARTS FOR PLATING

With the shortage of good steam coal and the substitution of cheaper grades, the problem of generating steam sufficient for keeping cleaning tanks at their proper temperature has become exceeding difficult. It is quite natural, therefore, that search should have been made for other means of doing this work. The answer was found in the use of gas, but gas applied in a way entirely new and novel. Gas had been used before, but in a way similar to that in which coal was used, that is to generate steam and pass this through coils in the tank. This, however, is slow and inefficient and there was no reserve capacity available for periods of extra activity. The Surface Combustion Company, combustion engineers, attacked this problem from a new angle, which was to burn the gas under the surface of a liquid. This was accomplished by using a development of the system of burning a complete mixture of gas and air and firing into a pipe coil, submerged in the tank. It is claimed that the results obtained were greater than anticipated. From a cold start the tank was boiling within one hour. Using steam coils the temperature was never more than 200° F. in three hours. The gas consumption indicated an efficiency of over 85%. The fuel costs are slightly less than the fuel and labor costs of the coal fired steam boiler, but the solutions are always hot, production is not held up and the work is not spotted but absolutely clean.

This equipment is made in seven sizes ranging from 100 gallon to 1,500 gallon capacity. Full particulars may be obtained from the Surface Combustion Company, 366 Gerard avenue, Bronx, New York City.



HOT CLEANING TANK INSTALLATION

ANTI-CORROSIVE SOLUTION

The S. A. Day Manufacturing Company, Inc., of Buffalo, N. Y., has placed on the market an anti-corrosion solution called "Gardco." The company states that Gardco Anti-Corrosive Solution positively prevents the rusting or corroding of iron, steel and zinc; has the appearance of an enamel or paint; resists the action of acids, alkalis, fumes and brine; will not blister under heat; can be applied in hot or cold weather with equal facility; is unaffected by moisture, earth or cellar dampness, salt air, spray or sea water, and is a splendid electrical insulator.

According to published statements, it is an old formula, used extensively abroad for many years.

DESCRIPTION

Gardco is a chemical, rather than a mechanical, combination of ingredients which are of themselves excellent preservatives of iron, steel and zinc from corrosion. The solution is about the consistency of varnish and, after it has been applied to a surface, becomes tough and hard.

Black and chocolate colors are ready now; red, gray, green, buff, stone and white are in preparation. Black hardens with a high gloss; the other colors with a medium gloss.

APPLICATION AND COVERING CAPACITY

Proper application is essential for successful results. The surface to be coated should be free from dirt, grease, acid, scale and rust. The solution may then be applied by spraying, dipping or with a brush. If a brush is used, it is important that it be new or one thoroughly cleaned and washed out in Gardco Thinner.

The consistency of Gardco as shipped is suitable for most surfaces. If, however, a thinner consistency is desired, Gardco Thinner specifically designed for this purpose must be used to guarantee proper results.

As the viscosity is practically constant, it may be applied with equal facility in hot or cold weather. It can be applied by any laborer, one coat in most instances being sufficient.

HARDENING AND ELASTICITY

The hardening takes place in two separate and distinct ways. The surface hardens by air drying, which is dependent primarily upon proper ventilation; and with proper ventilation, this hardening will take place within a few hours. This is a chemical hardening and not a drying process. It is claimed that the solution never becomes dry to the extent of chipping or curling, which accounts for its unusual elasticity.

PENETRATION THROUGH RUST AND SCALE

Applied over rust or scale, or paint which is unsound, owing to corrosion beneath, Gardco solution is said to penetrate the microscopic pores and fissures, loosen the scale and bring it off. Upon the thickness of the scale will depend the number of applications and the time of complete penetration. Once the scale has been loosened and removed, the surface of the metal is ready for a further coat which, when applied and allowed to set, will not come off even with a chipping hammer.

The American distributors for Gardco are Lockwood, Eslick & Pfohl, Ellicott Square, Buffalo, N. Y.

NEW BRITISH RUST-PROOFING

A new process of metal impregnation whereby, it is claimed, steel, brass and other metals can be rendered permanently bright and untarnishable has been discovered by Harold Rowe, a British chemist, and is being dealt with commercially by the Rowe Chemical Company of 13 Newbury Road, Hale End, London, E 4, England. It is said that the new process increases the electrical conductivity of metals at the surface, but does not impair or alter their appearance in any way. The application of the process is stated to be quite simple and to require no electrical appliances or apparatus. The liquid used, known as "Rustofite," is said to impregnate the pores of clean metal with hard, transparent crystals, which are electro-negative to such corrosive influences as acid fumes, brine, rain, smoke, spray, exhaust steam and tropical and Arctic climates. The compound is described as non-inflammable and non-poisonous. The cost of a complete outfit for rustproofing 2,000 square feet of metal is said to be less than one cent a square foot, and it is claimed that one gallon will save 500 working hours at present expended in cleaning, wiping-down, packing for storage, and in preventing general depreciation of plant and stock. The process is available also for rustproofing finished products.

MAGNETIC SEPARATOR

The Magnetic Manufacturing Company, Milwaukee, Wis., has designed and placed on the market a new type of Magnetic Separator, which it is claimed involves many new and useful improvements. This new separator is shown in the accompanying illustration.

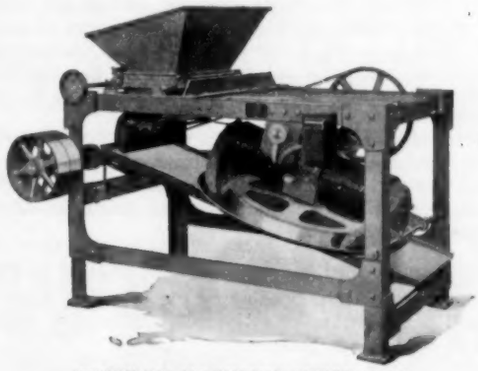
It has always been considered necessary and very essential that either wood or some other non-magnetic material be used in the construction of a magnetic separator in order to confine the magnetic lines of force to a point where the separation actually takes place. This type of separator, however, known as the Type "H" machine, is of all metal construction. The frame is of structural steel firmly bolted and braced and is so designed as to confine the lines of magnetic force to the point where separation takes place. In this design there are said to be leaks, i. e., the steel frame does not in any way affect the magnet nor is the steel frame affected by the magnet.

The magnet in the Type "H" machine is exceptionally strong. All electrical connections and lead wires are enclosed in an approved metal flexible conduit and all electrical and mechanical parts are readily accessible. Particular attention is called to the construction of the magnet. The entire magnet including the rotating magnet yoke is above the shaker. This feature causes the magnetic particles to be pulled out of the path of the material on the shaker lifting the magnetic materials sufficiently high to pass the non-magnetic material on the shaker. The rotating pan conveyor to which the magnetic particles attach themselves, carries these particles to the side of the shaker and automatically discharges them. The two magnetic poles, one at the upper and the other at the lower end of the shaking conveyor form a plus and minus magnetic pole. The magnetic material attached to the pan conveyor reaches a point between the plus and minus pole as it is carried away from the shaker. This point is known as the neutral point between the two poles of the magnet. The magnetic material reaching this point no longer being under the influence of the magnet drops off the pan conveyor.

A decided advantage is claimed in placing the entire magnetic element above the shaker as this overcomes difficulties formerly encountered. Where a part of the magnetic element is placed below the shaker, long pieces of steel such as nails, curled chips, etc., attach themselves to the separating element, and are held in a vertical position sweeping from the shaker a considerable part of the non-magnetic material causing a considerable loss.

Another feature is the adjustment of the shaker by means of an eccentric which at all times keeps the shaker exactly parallel with the separating magnet. A shaker adjustment is especially provided so that coarse as well as fine materials can be handled, which is also a necessary feature in effecting a separation of various materials, which may or may not be necessary to bring into very close proximity to the magnet. After the shaker has been adjusted to the proper position to effect the desired separation it can be locked securely. This adjustment feature is deemed important in order to maintain uniform separation over the entire shaker width.

Uniform coil windings are provided and the electrical connections are made so as to be easily changed from one voltage to another. The standard windings are for 110 or 220 volts direct current.

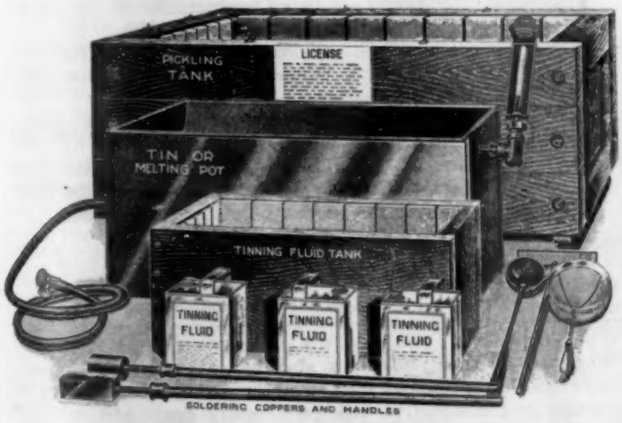


"TYPE H" MAGNETIC SEPARATOR

Type "H" Separators are provided with tight and loose pulleys for belting directly to a line shaft, or can be furnished with motors mounted on the Separator. Where no direct current is available, a small direct current generator is usually mounted on the machine. Switch panel with electrical instruments are mounted on the separator, thus providing a complete compact unit.

TINNING EQUIPMENT

The Callender Soldering Process Company, 12 South Jefferson street, Chicago, Ill., has placed on the market a complete tinning outfit, consisting of a pickling tank, tin melting pot, tinning fluid tank, tinning fluid ladle, skimmer, gas burners, soldering coppers, thermometer, etc. The outfit is designed especially for the retinning of milk and ice cream cans up to 10 gallons in size. These cans are revolved in the hot tin after pickling and dipping in the tinning fluid tank. In this way there is no necessity for taking cans apart.



CALLENDER TINNING EQUIPMENT

This equipment is said to be suitable for anyone engaged in the sheet metal business. Work can be done for creameries, dairies, ice cream companies, packers, meat markets, candy kitchens, bakers, hotels and restaurants.

NEW BRITISH OXIDIZING PROCESS

Among the methods for protecting metallic surfaces which have come to the front in England lately is the Brondse Oxidizing process. One of the advantages claimed for it is exceptional rapidity, in addition to the cheapness of the material used. Whereas it takes a week to oxidize a gun barrel by the ordinary process the Brondse process will produce a flat black (electro-black) in a few minutes or shiny black (auto-black) in less than half an hour. It is said to be a highly resistant protection against rusting, and to have very good wearing properties. The Brondse processes depend on the production of various and hitherto unusual oxides of great permanence and hardness. The method of application is electrolytic and rusty parts may be treated in the same bath. To produce an auto-black no electric current, however, is needed. The process has recently been specially developed for the protection of brass and copper and a large amount of work has been done in this direction. The color is generally bluey-black and is extremely hard. The surface is converted by an electric process to black oxide of copper and does not depend on any enamel, varnish or staining. A variety of coloring and bronzing effects have been achieved, and as the process is not akin to plating, there is nothing to flake off. The Brondse process has been taken up by Alexander Tucker, the well-known Birmingham metallurgist, by whom its applications have been largely extended.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

Headquarters, 140 S. Dearborn St., Chicago, Ill.

ANNUAL CONVENTION

The Twenty-eighth Annual Convention of the American Foundrymen's Association will be held in Milwaukee, Wis., the week of October 13, 1924.

In selecting the convention city the Board of Directors gave consideration to the demand for a location that would be convenient for foundrymen living in the middle and far west. This will be the first convention of the Association held west of Ohio since 1918, and the second since 1914.

Milwaukee is the sixth city of the United States in point of number of foundries, and ranks with the first in the extent and character of its foundry activities. It is convenient of access due to the fact that it is only a two-hour ride from Chicago which is the terminal of practically all trunk lines of the country, with hourly service over the C. & N. W., C. M. & St. P., and the North Shore Electric.

As in 1918, Milwaukee's Auditorium will be the center of activities. This splendid building has accommodations for exhibits, general and sectional meetings, all under one roof. The Milwaukee hotels have promised their co-operation and guarantee 2000 rooms for our members and guests.

EXHIBITS OPEN SATURDAY, OCTOBER 11

It is proposed to hold a four-day meeting, Monday to Thursday inclusive, with the exhibits opening on the preceding Saturday, as at Cleveland last year, making Saturday Milwaukee Day. The exhibits will not be open Sunday.

Detail information including hotels and rates, dates of section meetings, etc., will be announced later.

AMERICAN ELECTROCHEMICAL SOCIETY

Headquarters, Columbia University, New York City

PHILADELPHIA MEETING

Arrangements are being made which will afford a splendid opportunity for Society members to inspect Edgewood Arsenal. The Arsenal consists of eight main divisions: administrative, chemical, mechanical, medical, research, troops, plants and production, property, and chemical warfare school. Its operation on a peace-time basis, as well as the facilities that are available for war emergencies should be of interest to all of our members. The Excursion to Edgewood Arsenal is scheduled for Saturday, April 26th.

PHILADELPHIA PROGRAM (Tentative)

Thursday, April 24, 1924.

A. M.—Symposium on Organic Electrochemistry, Dr. C. J. Thatcher, Chairman.

Noon.—Lunch at Bellevue-Stratford. Round Table Discussions on "Electrodeposition" and "Refractories for Electric Furnaces."

2 to 5 P. M.—Visits to Industrial Plants: Philadelphia Mint; Welsbach Co.; Disston Co.; Dodge Steel Castings Co.; Ajax Wyatt Co.

6:00 P. M.—Board of Directors' Meeting.

8:00 P. M.—Session on Electric Furnace papers; or, Lecture by Dr. D. J. Barnett at Franklin Institute.

Friday, April 25, 1924.

9:00 A. M.—Annual Business Meeting. Presidential Address by the retiring President, A. T. Hinckley.

9:30 A. M.—Symposium on "Recent Progress in Electrodeposition," Mr. S. Skowronski, Chairman.

1:00 P. M.—Luncheon.

2:30 P. M.—Boat Ride to Kugler's. Trip to Airplane Factory and Westinghouse Co.

6:30 P. M.—Old-fashioned Planked Shad Dinner at Old Mohican Club, Morris-on-the-Delaware, N. J.

8:00 P. M.—Lecture at Old Mohican Club, by Mr. John Mills.

BRITISH INSTITUTE OF METALS

Headquarters, 36 Victoria Street, S. W. 1., London, England

The Annual General Meeting of the Institute of Metals was held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on Wednesday and Thursday, March 12 and 13, commencing each day at 10:30 A. M. The Presidential Address was delivered by Professor T. Turner, M.Sc., A. R. S. M., in the morning of March 12. No fewer than 14 communications—many of a very important character—were due for presentation and discussion at the meeting. The annual dinner of the Institute was held at the Trocadero Restaurant on Wednesday, March 12.

It is of interest to note—for the first time in the Institute's history—the membership passed the 1,500 mark on December 31, 1923. It is hoped by the Council that, as a result of the many activities of the Institute during the present year—particularly in connection with the British Empire Exhibition—this figure will be increased before the end of 1924.

The following Communications were to be submitted:

1. Alkins, W. E., M.Sc.—**"The Relation Between the Tensile Strength and the Electrical Resistivity of Commercially Pure Copper." (Note.)**
2. Bunting D., M.Sc.—**"The Brittle Ranges in Brass as Shown by the Izod Impact Test."**
3. Cook, Maurice, M.Sc., Ph. D.—**"The Cadmium-Lead-Zinc System."**
4. Friend, J. Newton, D.Sc., Ph.D., F. I. C., and J. S. Tidmus, B.Sc.—**"The Relative Corrosion of Zinc and Lead in Solutions of Inorganic Salts."**
5. Friend, J. Newton, D.Sc., Ph.D., F.I.C., and R. H. Vallance, M.Sc.—**"Determination of the Thermal Coefficients of Expansion of Some Commercial Metals and Alloys." (Note.)**
6. Iokibe, K., M.Sc.—**"Copper-Zinc Alloys which Expand on Solidification."**
7. Isihara, M.—**"The Equilibrium Diagram of the Copper-Tin System."**
8. Jenkins, C. H. M., B.Sc., A.R.S.M., and D. Hanson, D.Sc.—**"The Constitution of the Alloys of Copper and Cadmium."**
9. Jette, E. R., G. Phragmén, and A. F. Westgren, Ph.D.—**"X-Ray Studies on the Copper-Aluminium Alloys."**
10. Martin, Thomas, M.Sc., D.I.C.—**"The Tensile Properties of Aluminium at High Temperatures."**
11. Millington, W. E. W., M. Inst. C. E., M. I. Mech. E., and Professor F. C. Thompson, D. Met., B.Sc.—**"The Investigation of a Fatigue Failure of Brass Tubes in a Feed Water Heater—with a Consideration of the Nature of Fatigue."**
12. Rowe, Francis W., B.Sc.—**"The Effect of Casting Temperature on the Physical Properties of a Sand-Cast Zinc-Bronze." (Note.)**
13. Stockdale, David, B.A.—**"The Aluminium-Copper Alloys. Alloys of Intermediate Composition."**
14. Wilson, Stuart, H. J., B.Sc. (N.Z.), M.Sc. (Vic.)—**"Note on the Effect of Cold-Drawing and Annealing on Some Electro-chemical Properties of a Low-Tin Bronze."**

QUAD CITY FOUNDRYMEN

Headquarters, care of A. G. Hageboeck, Moline, Ill.

The Quad City Foundrymen's Association had a very large attendance at their February meeting at which Mr. E. T. Runge was the principal speaker. Mr. Runge gave a very interesting and instructive talk on foundry costs and substantiated the position that practical foundry costs could be obtained at a very reasonable cost. It is his opinion that many people attempt refinement in foundry costs that simply costs a lot of money and does not give results. His remarks were very enthusiastically received by the members present.

SOCIETY FOR TESTING MATERIALS

Headquarters, 1315 Spruce Street, Philadelphia, Pa.

The 1924 Annual Meeting will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., Monday, June 23, to Friday, June 27, 1924.

WASTE MATERIAL DEALERS

Headquarters, Times Building, New York

The eleventh annual meeting of the National Association of Waste Material Dealers, Inc., is to be held at the Hotel Astor, New York, on Wednesday, March 19, at 10.30 A. M. Among other matters of importance to come up at that time will be the election of a president and eighteen directors. Harry R. De Groat of Philadelphia has been re-nominated for another year as president and the board of directors has been increased from 25 to 31 including the president.

All the various divisions will hold meetings for the election of chairmen for the ensuing year and to transact any other business of importance which requires action.

The past year has been one of the most successful in the history of the association. The number of new members elected whose dues started with the beginning of the present fiscal year has been 128 and there are 20 applications pending at the present time. No such increase in membership has ever taken place before and the reason for same is undoubtedly due to the fact that the association has conclusively proved to the trade that it is rendering a service which makes membership almost indispensable. During the year a Southern division has been formed with over 30 members and the membership abroad has also been steadily increasing.

Changes have been made in rates on ingot brass and copper and in scrap metal minimum weights. For information communicate with H. F. Masman at the above address.

NEWARK BRANCH

Headquarters, Care of George Reuter, Secretary-Treasurer, 17 Central Ave.

On Saturday, April 26, 1924, Newark Branch, American Electro-Platers' Society will hold their Sixth Annual Banquet at Achtel-Stetter's Banquet Hall, 842 Broad Street, Newark, N. J.

The object of this Society is wholly educational. It consists of foreman electro-platers, chemists and others who are interested in the art of electro deposition and all its branches.

As in the past, they will hold, in conjunction with the banquet, an afternoon educational session, at which papers pertaining to the deposition and the various finishes produced on metal will be read and discussed.

Personals

W. A. COOK RETIRES

W. A. Cook of the Matthiessen & Hegeler Zinc Company, retired on February 1, 1924, after fifty-four years of service to the metal industries. Mr. Cook entered the metal business in 1870, when he joined the Essex Brass and Silver Rolling Mills of Newark, N. J. This concern was owned by P. Hayden & Sons. The mill was located at Bloomfield, N. J., while the fabricating department, brass foundry and polishing materials warehouse was situated in Newark. It was with this concern that Mr. Cook went through the business of learning the metal trades from the ground up. He was placed for a time in the mill and learned how to operate machines; among other things he actually learned the trade of a brass molder. He went through the office, mastering the bookkeeping and accounting work. He handled the sales and did purchasing for this concern at various times. He became known throughout the trade as the "Boy Buyer."

W. A. COOK

Mr. Cook remained with this company for over twenty years. At the end of that time he was in the position of general manager of the company, and knew the business of running a cutting-up shop and a house which sold brass foundry, plating and polishing supplies, from top to bottom. At that time the store of P. Hayden & Sons was the only one in the United States which carried a complete line of polishing materials. The polishing and plating supply business has grown enormously since then, but P. Hayden and Sons were the pioneers.

When P. Hayden died, the business was closed out and Mr. Cook went into the brass mill industry. After a short period he accepted a position as salesman with the Scovill Manufacturing Company of Waterbury, Conn. He was the only man in the employ of that company in that capacity, with the exception of the depot salesmen who were, of course, in charge of stores. Mr. Cook's work consisted of negotiating contracts and getting orders for the company, keeping the Waterbury office as his headquarters. He remained with the Scovill company for ten or twelve years working under C. P. Goss. With the Scoville company his record was a remarkable one; he handled large contracts, some of which have since amounted to accumulated totals of millions of dollars.

He resigned from the Scovill company to accept the presidency of a brass mill and cutting-up shop where he stayed for a few years. He left to enter the zinc industry with the Matthiessen & Hegeler Zinc Company as Eastern representative in their New York office. His work with this company was to spread the uses of zinc into new fields to replace other less suitable metals, and particularly to expand the use of rolled zinc. His work in this connection was most successful; he became one of the most prominent figures in the development of the ribbon and strip zinc industries, and built up this business from almost nothing to tremendous tonnages.

On February 1, 1924, he resigned to take care of his private interests which were pressing upon him. He has rounded out a total of fifty-four years in the metal trades and is still going strong. He states that his resignation does not mean retirement from the metal business or losing his interest in any way. He is working at the present time on mechanical and commercial problems of utmost importance to the zinc field, and will continue to operate on his own initiative.

C. M. Bunnell has joined the Pyrene Manufacturing Company, Newark, N. J., having formerly been general sales manager of the Torrington Company, Torrington, Conn. Mr. Bunnell will take charge of sales in the chain department.

William La Coste Neilson, vice-president and general sales manager of the Norton Company, Worcester, Mass., is making an extensive tour of Great Britain and western Europe on business for the company, and will be absent for about two months.

John O. Golden, Portland, Oregon, has sold out his interests in the John O. Golden Plating Company, and is now devoting all his time to a new invention called the Golden Jewelers Practical Electro-Plating Outfit.

H. E. Maynard, formerly with Maas & Waldstein of New York, has resigned to accept an appointment with the Anderson Chemical Company, manufacturers of lacquers, lacquer enamels and solvents, of Passaic, N. J. Mr. Maynard has been in the lacquer business for ten years and is known to the trade throughout the country. He will give his customers the same careful and conscientious service that he has always given.

Norman Russell, who has just been elected president of the New England Foundrymen's Association, has been a foundryman for about seventeen years. After graduating from Dartmouth College in 1906, Mr. Russell entered the employ of Albert Russell & Sons Company, Newburyport, Mass. During this time he had held positions in all departments of the company and is now its president. He heads several organizations and is active in state and municipal affairs. The company manufactures heavy castings, as well as bronze tablets.

Dr. H. W. Gillett, who for the past eleven years has been in charge of the Ithaca field office, Ithaca, N. Y., of the Bureau of Mines, devoting most of his time to electric brass furnaces and ferrous and non-ferrous alloys, has been appointed, effective March 1st, chief of the division of metallurgy of the United States Bureau of Standards, which has been vacant since Dr. George K. Burgess was made director of the bureau. In 1906 Dr. Gillett graduated from Cornell University, later receiving his degree of doctor of philosophy. He installed the research department of the Aluminum Castings Company, Cleveland.

J. H. Chaplin, vice-president and director of sales of the Root Company, Bristol, Conn., has just sailed for England. Mr. Chaplin has gone to England to look after the details of some large installations of Root Automatic Counters for some of England's most prominent textile mills. While in England he will make a close study of the particular methods used in that country. The Root Company manufacturers a complete line of small instruments, automatic in action, that will correctly record the production of every article, machine or hand made—whether wrapped, packed, conveyed, shipped, measured, grown, sold, bought, weighed, alive, dead or inanimate in any industry. They register revolutions or strokes of pumps, engines, dynamos, shafts, turnstiles, etc.

Elmer R. Murphy, president of the James H. Rhodes & Company is making a tour of South America to increase their foreign business. The James H. Rhodes & Company have recently completed a pumice mill in Long Island City, New York, which is said to be the largest in the world. They also have doubled the capacity of their felt and polishing buff plants in Jersey City, New Jersey.

Deaths

BERNARD SCHUTZ

Bernard Schutz, president of the Eagle Smelting & Refining Company and of the Somerville Iron Works, with offices in the Woolworth Building, died recently at his home 16 East Seventy-first Street, from heart disease. Mr. Schutz was 68 years old and unmarried. He was born in New York in 1854 and at an early age became engaged in the smelting business. His rise in this field was steady and at his death he was reputed to be one of the leading metal dealers in the country.

EDWARD SAWYER

Edward Sawyer, president Atlantic Insulated Wire & Cable Company, Stamford, Conn., died January 21, at Jekyl Island, Ga., after a short illness, at the age of 49 years. Mr. Sawyer was born in Dover, N. H., and graduated from Yale in 1898. Early in his career he was connected with the American Trading Company, N. Y. In 1902 he organized and became president of the Atlantic Insulated Wire & Cable Company.

EDWIN C. GOSHORN

Edwin C. Goshorn, died in Cincinnati, Ohio, February 7, at the age of 79 years. Mr. Goshorn was general manager of the National Lead Company, New York.

JOSEPH J. LACY

Joseph J. Lacy passed away February 7 at his home in Baltimore, Md., after an illness of several months. Mr. Lacy was president of James J. Lacy Company, iron founders, and owner of the Enterprise Brass Works, Baltimore, Md. He was the eldest son of James J. Lacy and succeeded his father as president of the foundry company.

H. E. DILLER

Following a brief illness, H. E. Diller died at his home in Lakewood, Ohio, on January 17. Mr. Diller was metallurgical editor of The Foundry, and was a member of a number of Technical Societies. He brought to all his work a wide experience on metallurgical subjects, in which he was recognized as a specialist. He became associated with The Foundry in 1919, prior to which he had held important positions with the Western Electric Company and the General Electrical Company, notably in the physical testing laboratories of the latter company at Erie, Pa. Mr. Diller left an enviable record of achievement in the field of metallurgical engineering.

WALLACE HETHERINGTON LINN

As we go to press word is received of the death on March 3, 1924, of Wallace Hetherington Linn, Treasurer of E. A. Williams & Son, Inc., Jersey City, N. J.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

March 3, 1924.

AMERICAN BRASS COMPANY OFFICERS

No change was made in the directors or officers of the **American Brass Company** at the annual meeting of the company held last month. The officers, all of whom were re-elected are:

Chairman of the board, **Charles F. Brooker;** president, **John A. Coe;** executive vice president, **Edward L. Frisbie;** treasurer, **Clifford F. Hollister;** assistant treasurer, **Major W. Judge;** assistant treasurer, **S. Burnham Terry;** secretary, **Edmund H. Yates.** These were all re-elected at the directors' meeting in New York Feb. 7th. On the 5th the stockholders in annual meeting elected the following directors, the same as last year: **Charles F. Brooker, John D. Ryan, Cornelius Kelley, John A. Coe, Benjamin B. Thayer, Edward L. Frisbie,** Clifford F. **Hollister, George A. Allen and Edmund H. Yates.**

SCOVILL COMPANY OFFICERS

Absorption of the **American Pin Company** and the Oakville **Pin Company** by the **Scovill Manufacturing Company** showed its result in the abandonment of any annual meeting of the two former concerns and in the electing of their former officers as vice presidents and assistant secretaries of the Scovill Manufacturing company at its annual meeting.

Just prior to the annual meeting of the Scovill company, **Harry B. Jenkins,** assistant secretary of the American Pin company resigned and his resignation was accepted. He has

left the city and it is understood that he has taken employment in Hartford. He had been with the Waterville concern many years.

At the annual meeting of Scovill company stockholders, the same directors as last year were elected, namely:

Mark **L. Sperry, E. O. Goss, John H. Goss, Clayton M. DeMott, C. P. Goss, Jr., L. P. Sperry, F. J. Kingsbury, W. Shirley Fulton and George A. Goss.** The directors met immediately after and reelected the following officers:

President and general manager, **E. O. Goss;** vice president and general superintendent, **John H. Goss;** secretary, **Leavenworth P. Sperry;** assistant secretary, **Thomas Myers;** treasurer, **Clayton M. DeMott;** assistant treasurer, **Frank J. Gorse.**

The directors also elected the following additional officers, formerly officials in the plants absorbed: Vice president, **Bennett Bronson,** former president and treasurer of the Oakville company; vice president, **T. I. Driggs,** former president and treasurer of the American Pin company; assistant secretary, **W. W. Bowers,** former secretary of the American Pin company; **Charles F. Doherty,** former secretary of the Oakville.

They also gave recognition to the work of two long time Scovill men by electing **Burden P. Hyde** an assistant secretary and **William M. Goss** an assistant treasurer.

George Boden, who has been general manager of the Oakville company for many years, was appointed general manager of the Oakville company division of the Scovill company and **T. I. Driggs** was appointed general manager of the American Pin company division of the Scovill company. **Fred E. Bartlett,** former vice president of the American Pin company was appointed assistant general manager of the American Pin company division.

The directors voted a quarterly dividend of $4 to be paid April 1st. The company's financial statement for the year 1923 shows a net gain of $3,167,760.74 for the year which was transferred to surplus. Of this $2,683,960.15 was acquired by the Scovill company proper; $246,209.45 by the Oakville company branch and $237,591.14 by the American Pin company branch. The statement also shows a total surplus of assets over liabilities of $10,133,413.42 and in addition a surplus reserve of $5,826,078.98. The value of land, building and machinery is given as $27,311,573.87, less reserve for depreciation and replacements of $15,139,956.14. Current assets, such as cash, call loans, government securities and other marketable securities amount to $10,545,874.31, accounts and notes receivable $2,587,976, merchandise inventories $8,844,903.49. Other assets such as stocks in other companies, mortgage notes, equities in buildings and patents amount to $849,518.28.

WATERBURY CLOCK COMPANY OFFICERS

All former officers of the **Waterbury Clock Company** were re-elected at the annual meeting of that company, the directors re-elected being: **Irving H. Chase, Frederick S. Chase, Alfred Hart, William H. White, Clifford H. Hall, H. B. Dumont and George M. Van Deventer.**

Officers re-elected are: President and treasurer, **Irving H. Chase;** vice president, **William J. Larkin;** secretary, **Clifford H. Hall,** assistant secretary, **Harry B. Dow.**

Voluntary dissolution of the **Novelty Manufacturing Company,** located at Maple street, was made effective through the filing of papers in the Superior court last month. This does not mean that the factory is to discontinue operations, according to its officials but is due to the acquiring of all the company's stock by the **Risdon Manufacturing company** of Naugatuck. Most of the former officers of the Novelty company and chief stockholders are also officers and stockholders in the Risdon company.

Members of the Chase Foremen's association held their annual entertainment and dance on the 21st of last month in Buckingham hall. The public was invited.

Members of the American Pin company foremen's association held their annual banquet at The Elton on the 18th of last month. Charles R. Towson spoke on "Making Industrial Relations Safe and Sane."—W. R. B.

BRIDGEPORT, CONN.

March 3, 1924.

Jenkins Brothers, valve manufacturers, added 100 to their working force Feb. 11, when work was started in the new factory plant, just erected on the site of the old Belknap factory. The force will be increased during the year and it is expected that by the end of the year there will be 500 men employed in this new plant.

Edmund C. Mayor, vice president of the **Gorham Manufacturing Company** of Providence, parent company of the **Whiting Manufacturing Company** of this city, has denied reports in circulation here that a proposed consolidation of the Gorham company interests contemplated removal of the local plant from this city. Mr. Mayor explained that a plan is before the stockholders to effect a consolidation of all Gorham interests for the purpose of administration. The rumor probably grew out of this proposed consolidation, he said.

The stockholders of the **Lake Torpedo Boat Company** at their annual meeting, authorized their directors to retire as funds are available, the outstanding issues of $628,000 first preferred and $1,200,000 second preferred stock. The retirement of the two issues awaits the settlement of the government accounts growing out of war and pre-war contracts, the claims aggregating over a million dollars. The company directors have authority to sell real and personal assets, consisting of shipyards at Bridgeport. No move has been made in this respect inasmuch as the company is marking time on prospects of securing the contract for three large cruising submarines for which Secretary Denby has asked Congress to allow appropriation. Secretary Adams of the firm was in Washington last month looking after this prospect. If ordered, they will be larger than any ever built before.

The stockholders accepted the resignations of **J. H. Kissick** and **Philip B. Brill** as directors and reelected **Henry J. Miller, Simon Lake, C. E. Adams** and **R. P. Mills** as directors.

The local Chamber of Commerce, at a meeting last month, appointed a committee to advertise Bridgeport throughout the country as a likely location for all kinds of manufactures, and to revive and push to a conclusion the project of making Bridgeport a port. It is proposed to adopt a slogan, possibly such as "Made in Bridgeport—The Industrial Capital of Connecticut."—W. R. B.

NEW BRITAIN, CONN.

March 3, 1924.

Manufacturing conditions in this city continue along the high road of prosperity, with no indications of a mid-winter slump or any falling off in the spring. On the other hand, everything points to continued or even increased business. For instance, the **Russell & Erwin** branch of the **American Hardware Corporation** already is cramped for manufacturing quarters and has prepared to start at once with the construction of a new six story building for general manufacturing purposes at a cost of $120,000. The **Stanley Rule & Level Company** is practically finished with the construction of a new six story addition at its main plant and another big addition at a branch factory is being rushed along.

The biggest thing in the local manufacturing world, however, is the upheaval at the **Bristol Brass Company** where one faction of stockholders, led by **Roy H. T. Barnes,** a prominent broker, is making a concentrated effort to drive from the presidency and active management **A. F. Rockwell,** long head of the concern, once associated with the **New Departure Manufacturing Company** and also identified with the **Marlin-Rockwell** munitions works during the war. Mr. Rockwell on the other hand is contesting the matter and when the annual meeting of the stockholders is held on February 29 a hot fight is assured. The opposition charge Mr. Rockwell with mismanagement and claim that it may be necessary to put the concern in the hands of a receiver if he is retained in office. Rockwell on the other hand insists the business is slowly returning to normal and without being hampered by proteges of the brokerage interests he will get the company back on its feet. This fight has extended even into the **American Silver Company,** of which Mr. Rockwell was a director. At the annual meeting February 26 he was deposed by about the same lineup of forces as oppose him in the Brass Company.

The **P. & F. Corbin** branch of the American Hardware Corporation is finding plenty of work in keeping abreast of orders for builders' hardware and at the **Corbin Screw Corporation** demand for machine screw products and other outputs of this

branch keeps things going on full time. The **North & Judd Manufacturing Company** proceeds at normal capacity in the manufacture of buckles, harness trappings, etc., and **Landers, Frary & Clark** is busier than ever in its electrical equipment departments as well as its cutlery branch. The manufacture of pressed aluminum kitchen and household utensils also progresses well.—H. R. J.

TORRINGTON, CONN.

March 3, 1924.

With all the shops operating on full schedules and orders coming in satisfactorily, the industrial situation here is highly encouraging. One or two of the plants—notably the **Torrington Branch** of the **American Brass Company**—are using night shifts. Some have sufficient orders on hand to keep them busy until May. The number of workers employed is larger than in the pre-war period and the wages are good. There is room for improvement in the housing situation but the Chamber of Commerce is planning to inaugurate a home-building campaign this spring which it is expected will tend to relieve conditions. So far as raw materials are concerned, the manufacturers for the most part are buying from hand to mouth in anticipation of reductions in prices.

James H. Graham, Jr., 21, only son of **James H. Graham**, former superintendent of the Torrington Company plants here, died February 23 of pneumonia. The young man was associated in business with his father who is now president and manager of the **J. H. Graham Company.**

Thomas W. Bryant of the **Union Hardware Company** has been re-elected president of the **Torrington Club.** The vice-presidents are **Edward H. Hotchkiss** and **Henry G. Ellis**; the treasurer, **John H. Seaton**; and secretary, **D. Fred Hildreth.**

A. C. Raspiller, director of the **Community Co-operative Company** from the American Brass group of stockholders, has retired as president of the co-operative company. **Hugh Cameron** of the **Hendey Machine** group succeeds him. **Patrick Humphries** of the **Standard** group is the new vice president and **Henry J. Healey** of the **Excelsior Needle** group, secretary and treasurer.—J. H. T.

PROVIDENCE, R. I.

March 3, 1924.

There were 12,495 more persons employed in the factories, mills and stores of Rhode Island in 1923 than there were in 1922, according to the annual report of **J. Ellery Hudson**, Chief Factory Inspector, submitted to the General Assembly recently.

There were 1,100 accidents caused by machinery reported during the year, five of which were fatal. Mr. Hudson concludes his report with this statement:

"Again I recommend that serious attention be given the question of providing adequate means of egress from factories and workshops in case of fire. An act will be presented shortly requiring that all new buildings erected, to be used for these purposes, shall be equipped with the so-called 'Philadelphia Tower Fire Escape,' which is acknowledged by the leading engineers of the country to be the best means known for providing a safe exit."

About 75 superintendents and foremen of jewelry factories in Providence and the Attleboros met at a smoker in the **Jewelry and Silversmithing Department** of the **Rhode Island School of Design** recently to hear the report of a committee appointed early in the winter on the desirability of reviving the apprenticeship system in the jewelry trade, and to listen to a talk on the system for training apprentices at the Brown & Sharpe Manufacturing Company's plant here.

The committee's report advocated a concerted movement by manufacturers toward the encouragement of boys to enter the factories as apprentices and to supplement the shop training with the instruction of the School of Design. The committee, having completed its duties, was discharged and a new committee appointed to carry on the work. The new members chosen were **Samuel Adams** of the **Waite-Thresher Company; Eugene Moorehouse** of **B. A. Ballou & Company, Inc.; Elmer Smith** of **R. F. Simmons Company; Squire Greenhalgh** of **V. E. Black Company; John J. Foley** of **Parks Bros. & Rogers Company; David McMurray** of **W. E. Richards Company** and **C. K. Greer** of the **Irons & Russell Company.**

The D. Evans Company, of North Attleboro, has become an incorporation, its purpose being to manufacture and generally deal in buttons and jewelry, with an authorized capital of $10,000. James Lavery is president, Clyde Barnhill, secretary-treasurer, and Anthony Lavery, a member of the board of directors along with the president and secretary-treasurer.

N. H. Haronian, manufacturing jeweler, 38 Friendship street, has purchased 12,000 square feet of land at Manucentre, upon which he will begin the erection of a new jewelry factory in the near future to cost about $40,000.—W. H. M.

MIDDLE ATLANTIC STATES

PHILADELPHIA, PA.

March 3, 1924.

Since last month, the industry in the Philadelphia district has shown signs of gradual improvement in most of the trades. The pessimism prevailing recently has virtually disappeared and merchants are now accepting the trade trends in a better attitude. Most of the better outlook feeling can be attributed to large building developments projected, factory construction and municipal buildings with their attendant great consumption of metals.

The tin market is continually accumulating strength occasioned by the demand from galvanizers and tin plate manufacturers who are receiving orders for the Summer canning season. It is reported that most of the tin mills are working at 75 per cent. capacity.

The **William Cramp and Sons Ship and Engine Building Company** has received several large orders for bronze products and the demand for metal for their fulfillment is expected to be met in the local market. No intimation has yet been given as to the value or the size of the orders. The bronze market is firm with virtually the same prices prevailing. Small foundries specializing in the manufacture of tablets and memorials and also those making propellers for small pleasure craft are experiencing a fair demand for their products.

Several new contracts have been placed by lighting fixture companies for nickel and silver plating. The business generally, however, is unchanged with the demand expected momentarily as it is reliably reported that many of the women's fashions this Summer will be trimmed with plated metal.

Scrap metal smelters' trade is steady with offerings of old metal continuing in volume with an almost similar demand for the smelted product.—A. F. C.

NEWARK, N. J.

March 3, 1924.

Federal Judge Runyon has referred to George W. Porter as special master the question of whether an offer of 25 per cent. composition should be accepted in the case of the **Atlantic Smelting and Refining Company.** Mr. Porter will report on the advisability of accepting the offer, whether the majority of the creditors are willing and other subjects after holding a meeting of creditors. If his report is favorable creditors will show cause before Judge Runyon March 17 why the order should not be confirmed. Jacob L. Newman was appointed referee for the concern in Chancery Court. An involuntary petition in bankruptcy was filed recently in the federal court for the purpose of effecting the composition.

New Brunswick stockholders of the **Aluminum Wheel Company of America**, which has a plant at that place, will have representation on the board of directors. This is assured by an agreement between Russell E. Watson, of New Brunswick, counsel for some of the stockholders, and Conover English, as counsel for **Horace K. Corbin**, receiver for the **American Non-Ferrous Metals Corporation**, Elizabeth, which concern holds a controlling interest in the wheel company. Many residents of New Brunswick invested a total of about $20,000 in

the concern. The wheel company's plant is now idle. The receiver of the metals company, in addition to holding majority stock in the wheel company, also has the patents under which the wheels were to have been manufactured.

Van-Le Corporation, of 100 Sip avenue, Jersey City, N. J., has been incorporated with $100,000 capital to manufacture radio supplies of every description. The incorporators are Willard Van Blaricom and Ethel Van Blaricum, of 22 St. Luke's Place, Montclair, N. J., and Walter LeBlanc and Annabelle LeBlanc, of 103 Hillside avenue, Hillside, N. J.—C. A. L.

TRENTON, N. J.

March 3, 1924.

Metal plants in Trenton report business as being good at the present time and expect a good season. Two of the largest concerns have awarded contracts for new additions. The **Jordan L. Mott Company** has let a contract with the **Newton A. K. Bugbee Company** for a steel addition to the foundry. The addition will cost $10,000. The **John A. Roebling's Sons Company** will erect a brick addition to the wire shop on Elmer street. The company will do its own building.

The majority of the metal concerns in Trenton displayed goods in the annual **Products Exposition,** held under the direction of the Trenton Chamber of Commerce. The exhibition was in Trenton store windows. Those who exhibited were: Jonathan Bartley Crucible Company, Pyrolectric Company, Orr Machine Guarding Company, Trenton Brass and Machine Company, Trenton Emblem Company, Westinghouse Lamp Company, Skillman Hardward Manufacturing Company, Jordan L. Mott Company and the John A. Roebling's Sons Company.

L. O. Koven & Brother, Inc., of 154 Ogden avenue, Jersey City, N. J., has been incorporated at Trenton with $2,000,000 capital to take over the going concern by that name and manufacture tanks and other equipment made of metal. The incorporators are Marie E. Koven, and Wilhelm P. Koven, of 25 Trinity Place, Montclair, N. J.; Gustav H. Kover, 154 Ogden avenue, Jersey City, N. J.; Elizabeth K. Raetzer, 25 Trinity Place, Montclair, N. J., and Rudolph C. Koven, Jr., 291 Central Avenue, Jersey City, N. J.

Hearings in the suit for a permanent injunction to restrain the **De Forrest Radio Company** of Jersey City, N. J., from manufacturing certain radio tubes were continued before Vice-Chancellor Lewis on February 25. The suit was brought by the **American Radio Corporation,** which secured temporary injunction several months ago. Defense counsel says the company's product is not in question, on the ground that it is not identical in structure with the tubes over which the plaintiff brought the action.

Reliance Electric Company, Camden, N. J., has been incorporated to manufacture electrical appliances; $50,000 preferred stock and $3,000 shares common.—C. A. L.

ROCHESTER, N. Y.

March 3, 1924.

The month of February has not carried much encouragement to the average manufacturer in Rochester, from the fact that business has been conducted on a reduced scale and the prospects are not so cheerful as had been anticipated. Just what has caused this condition is not readily understood, as it was figured, shortly after the beginning of the new year, that greater activity would develop in all plants utilizing metals.

Reports from leading foundrymen today indicate that the brass-workers have been barely moving along this month, and that but for a little additional local business during the past two weeks positive dullness would have been recorded for the entire month. Brass foundrymen, however, have hopes of improved state of trade after March, as they claim continued quietude cannot long endure.

Not so much activity among the metal workers in the **Eastman** kodak plants or at the **Bausch & Lomb** optical works as prevailed in January, but persons in authority say February is always the light month of the year, so far as business is concerned in these two extensive industries. The plant of the **General Railway Signal Company** in Lincoln Park is very busy, owing to the fact that several large foreign orders for railway signal equipment were obtained late last year. **Yawman & Erbe,** the **Rochester Can Company, Pfaudler Works,** and **Todd Protectograph Company's** plant are operating under fairly normal conditions. All of these concerns require much copper, brass, bronze and aluminum in the making of their products.—G. B. E.

MIDDLE WESTERN STATES

PITTSBURGH, PA.

March 3, 1924.

Business conditions in the metal industry, in Pennsylvania continue about the same as last month.

The **American Safety Razor Company** declared the regular semi-annual dividend of 25 cents. There had been some talk of an increase at this time.

Lockmakers are enjoying a fair amount of business. The building trades are consuming fairly large quantities of door locks and fittings. The most desirable for this use are the type with the lock incorporated in the knob and catch device. Padlocks are selling in fair volume, especially those suitable for automobile purposes. Trunk and suitcase manufacturers are making inquiries for fairly large quantities of locks and indications are that a substantial business will develop from this source in the near future. There is no change in price.—H. W. R.

DETROIT, MICH.

March 3, 1924.

It is announced that the **Detroit Testing Laboratory** has recently let contracts for the erection of a brick and steel laboratory building for its own needs, at the northeast corner of Second Boulevard and Bagley avenue. This laboratory was established about 20 years ago, and first was located on the top floor of the Union Trust building. It does not now confine itself to any one kind of work. While it does a great business in the testing of metals, it also makes various other tests.

At a recent meeting of the **Michigan Stove Company** the following officers were elected: Chairman of the Board of Directors, G. A. Barbour; president, C. A. DuCharme; first vice-president, Francis Palms; vice-president and factory manager, E. J. Dwyer; secretary, C. B. DuCharme; treasurer, H. B. Gillespie; general manager, L. B. Young. Reports presented indicated that the volume of business transacted in 1923 exceeded that of previous years. The directors declared the customary annual dividend of seven per cent. on the preferred stock.

The **Zenith Carburetor Company** has been incorporated here for the purpose of manufacturing carburetors. The stockholders are L. L. Jose, 4468 Vancouver ave.; T. W. Noland, 4324 Dix avenue, and J. O. Webber, Oregon avenue.

It is announced that the Northville, Mich., plant of the **Ford Motor Company** is now employing about 375 men while at the Phoenix plant there are approximately 200 women workers. More than 100,000 valves a day are being manufactured at the Northville plant.

The plant of the **Aluminum Castings Company** at Detroit, it is announced, has been purchased by the **Mutual Electric & Machine Company,** manufacturers of safety switches, switchboards and panelboards. The property, comprising about eight acres, half of which is under roof, is located on Joseph Campau avenue near the **Dodge Brothers'** motor car plant. It is understood the Mutual Electric & Machine Company plans to condition its newly acquired plant as rapidly as possible and vacate its two present plants, one at Fort and Fourth streets and the other at Porter and Fourth streets. The company sells its product all over the world and present plans call for a large increase in output. It is understood several hundred additional men will be employed.

It is announced the **Great Western Smelting & Refining Company** plans to move into its new plant about March 1. The structure will cost approximately $300,000 and will allow for carrying in Detroit of greatly increased stocks of metals. Facilities for speeding up manufacture also are provided in order that the automobile industry may be served promptly. The new plant is located at Russell street and Woodland avenue and runs through to Highland avenue. The Grand Trunk railroad furnishes ample switching facilities. According to **J. B. Neiman,** the company's local manager, the new plant will be able to give extensive service to Michigan, Ohio and other middle western states.—F. J. H.

CHICAGO, ILL.

March 3, 1924.

Good business, with prospects that it will be even better during the next few months, is reported by the metal companies of Chicago. The trade is decidedly optimistic over expectations for at least the first half of the year. A few plants which report a slight seasonal slump in business right now see signs of improvement. Tonnage is good and inquiries are good, the companies agree.

Business in general has been good since November 15, according to the **Hoyt Metal Company.** This company reports that there is a slight decline in business at this time, but it is believed to be temporary and prospects are declared to be encouraging. Tonnage is good and inquiries are good.

Business is good and prices are high, said **W. P. Carroll** of the **National Lead Company.** He declared that prospects are excellent and predicted that prices will go even higher.

Production of the **Great Western Smelting and Refining Company** is above normal, according to **R. G. Raphael,** sales manager. This company is building new plants at St. Louis, San Francisco and Detroit, Mr. Raphael said. The St. Louis plant now is almost ready for operation, and the Detroit plant is expected to be ready in about two months.

The **Globe Metal Company** is optimistic over the business outlook, according to **George Birkenstein,** purchasing agent. Lead is exceedingly high and may go higher. Copper is the only line that is not so good now, but reports to the company are that consumption is cutting down the surplus and the market should show improvement during the next few weeks.

The **Inland Metals Refining Company** reports a slight slump in business now, but expects improvement within a short time. This company is another that finds prices unusually high. At the **Northern Metal Company** also it was said that business has shown some decrease, but it is expected to pick up.

H. L. Lemmon, president of the **Monarch Metal Company,** declares that business has been somewhat slow for the last sixty days, but adds that it already is improving and he expects the gains to continue. His company's plant is busy, he said, and the business prospect for the next few months is bright. The general trend of prices has been upward, he asserted.

The metal business looks better than ever to **H. B. Dickinson,** department manager for the **International Nickel Company.** He said his company's plant is operating at about 85 per cent of its capacity.—L. H. G.

INDIANAPOLIS, IND.

March 3, 1924.

To give long-time employees opportunity to buy an interest, **Frank H. Langsenkamp** has incorporated the Langsenkamp coppersmithing and canning equipment manufacturing business, at 130-142 East Georgia street, Indianapolis, under the name of the **F. H. Langsenkamp Company.**

George P. Hulst of Hammond, Ind., and his associates have closed a deal whereby they acquired the controlling block of stock in the **Hulst-Staplin Lead Company,** of East Chicago, which had formerly been held by L. D. Staplin. The company has been reorganized under the name of the **Hulst Lead Company,** with the following officers: President, George P. Hulst; vice-president, E. P. Kelly; treasurer and general manager, T. M. Egan. The plant is located on the old site of the American Conduit Company, in East Chicago and is one of the city's younger industries. It started operation last March.

The decision of the Hendricks, Ind., circuit court, June 11, 1920, that Henry P. Davis, of New York City, should receive $10,000 damages from Herbert R. Duckwall, as president, and others of the **Zenite Metal Company,** for malicious prosecution, was reversed by the Indiana supreme court recently. The court ordered a new trial. It said in its decision that it expressed no opinion "concerning the sufficiency of the evidence, nor whether the damages were excessive." The reversal was based on methods of legal procedure. Davis was possessor of a secret metal modeling process and came here to work for the company, according to papers on record, but soon returned to his eastern home, whereupon the company began action which landed him in jail in Indianapolis. He was acquitted and then brought action for damages.

John Cook & Company are moving their plant for the manufacture of aluminum ware to 1717 Gent street, Indianapolis.—E. B.

FOREIGN

BIRMINGHAM, ENGLAND

February 19, 1924.

In the brass trade up to the present, business has maintained a fairly satisfactory level. Australia, in spite of the encouragement given there to home manufacturers, has continued a good customer to this country, especially for steam and water fittings. Cabinet brassfounders are now getting more business from India. There has been a slight resumption of trade with the Continent in steam and water fittings, but this is practically confined to Holland. Demand from the furniture trade has fallen off, but a little more business is now coming from the shipyards. Wire drawers are getting busier, but orders for sheets and tubes are not coming in as well as the recent activities of shipbuilders and the railway plant firms would have suggested. Aluminium casters are getting a steady flow of work from the motor trade, as are also the makers of extruded rods. The latter are also benefiting by the continued growth of the demand for parts for wireless receiving apparatus. The electro-plate trade shows little improvement, the goods in demand being chiefly those of the cheaper class. Articles for advertising distribution are keeping a few firms busy. The jewelery trade since Christmas has lapsed into its former state of depression.

The competition of the British Royal Mint with the business of the medallists industry, reference to which was made in this column two or three months ago, has been made the subject of protest in the interests of the medallists who practice independently. The Birmingham Chamber of Commerce, acting in concert with the Birmingham Jewelers' Association and the London Chamber of Commerce, sent a deputation to the Deputy-Master of the Mint. A deputation to the Chancellor of the Exchequer, who is also Master of the Mint, was arranged for, but the change of Government has intervened.

NEW GOLD JEWELRY STANDARDS

Measures for the protection of purchasers of cheap jewelery and other articles in the description of which the names of the precious metals are used have been under consideration for a long time past. Efforts were made by the Birmingham Jewelers' and Silversmiths' Association, in co-operation with other trade organizations, to secure definite standards of quality by the establishment of trade customs, but this policy has not proved successful. A Bill has now been introduced into Parliament for the purpose of giving legal recognition to these standards for such descriptions as rolled gold, gold-cased and gold fronts. "Rolled Gold" is one of the most misused trade descriptions, the chief offenders being foreign manufacturers, who at present with impunity can sell in Great Britain articles very thinly plated. Under the descriptions, "gold-cased" and "gold front" a great many vat-plated articles are imported and sold.—G.

Business Items—Verified

Keystone Silver, Inc., 165 West 18th street, New York City, was slightly damaged by fire.

Armstrong Cork & Insulation Company has established a new sales office in Buffalo, N. Y., at 625 Genesee Building.

U. T. Hungerford Brass & Copper Company has opened a new office and warehouse at 3035 St. Clair avenue, Cleveland, Ohio.

The **Milwaukee Die Casting Company,** 279 Fourth street, Milwaukee, Wis., has increased its capitalization from $75,000 to $150,000.

Detroit Electric Furnace Company has moved from Book Building, Detroit, Mich., to 2331 First National Bank Building, Detroit, Mich.

Michigan Screw Company, Lansing, Mich., has established a new department for sherardizing work, and plans to advance equipment and production in this branch.

An exhibition of the evening classes will be held on Thursday evening, March 13, 1924, in the School of Science and Technology of **Pratt Institute,** Brooklyn, N. Y.

The Ohio Brass Company, Mansfield, Ohio, reports for the year ended December 31, 1923, net profits of $1,911,236. These earnings compare with net profits of $1,398,864 in 1922.

The die-casting department of the **Light Manufacturing and Foundry Company,** of Pottstown, Pa., has been taken over by the **Doehler Die Casting Company** of Brooklyn, N. Y.

The **Kaufman Metal Company,** Jacksonville, Florida, is in the market for one motor-driven, direct-connected blower for a 40" cupola. This concern operates a brass and iron foundry.

An **Exhibition of Industrial Art** of American manufacture was held in the Museum of Natural History, New York, during the month of February. This included a wide variety of metal objects.

The **Liberty Wire Frame Company** has taken new quarters in the building 313 East 23rd street, New York City, where it manufactures wire goods of every description for lamp shades and lighting fixture trades.

The **Philadelphia Coppersmithing Company,** 222 North Front street, Philadelphia, Pa., has filed plans and will commence the immediate construction of an addition to its plant at 810-14 North Front street, estimated to cost $25,000.

The **Bridgeport Brass Company,** with main offices and factory at Bridgeport, Conn., has recently removed its Philadelphia offices from the North American Building to the Bankers Trust Building. **Lenox C. Chew** is manager of that branch.

The **Chipman Chemical Engineering Company** of New York started its new arsenic reduction works at Martinez on San Francisco Bay, producing refined white arsenic from ores shipped into the plant from various points in California and Nevada.

J. Holland and Sons, formerly in the Machinery Exchange, have now entered into the buying and selling of second hand and new plating, polishing and grinding equipment. They will continue to operate at 489 Broadway and 13 Union avenue, Brooklyn, N. Y.

J. Schwartz, manufacturer of all kinds of silver-plated ware, has removed from 720 East 11th street, to larger premises at 67-69 Spring street, New York City. This firm operates the following departments: brass machine shop, casting shop, tool room, cutting up shop, spinning, polishing, plating, soldering, lacquering.

Seamless drawn kettles, seamed tanks and tank linings, steam coils, cocks, valves and fittings, as well as pails and dippers of Monel metal, to withstand the action of sulphuric acid are now being offered by **Sholes, Inc.,** 186 Lafayette street, New York City. The same company is also now making trays, etc., of chrome iron to withstand nitric acid and aqua fortis.

The Detroit office of the **Armstrong Cork & Insulation Company** is now prepared to handle contract work for the insulation of steam lines and other power plant equipment, brine and ammonia lines, brine coolers, tanks, etc. Nonpareil high pressure covering and Nonpareil cork covering are carried in stock in Detroit. Office and warehouse are located at 453-7 Fort street, W., Detroit.

The **City Foundry Company,** Hartford, Conn., recently organized with authorized capital stock of $50,000, will manufacture and deal in all non-ferrous metal castings, and will operate a cleaning room sufficient to clean castings of the above nature. Bearing bronze, match plates and pattern castings are specialties. This concern operates the following departments: brass, bronze and aluminum foundry.

The **Merkel Brothers Company,** Cincinnati, Ohio, manufacturers and wholesale distributors of plumbing and heating supplies, has awarded a contract to the Austin Company, general contractors, Cleveland, for a complete new plant, consisting of a mill building, pipe building, garage, boiler room, coal storage and all mechanical equipment, including railroad track installation, project to cost half a million dollars.

The **Wheeler Condenser & Engineering Company,** Carteret, N. J., has construction in progress on a one-story foundry, 100 x 412 ft., for the production of iron and brass castings. Contracts for certain equipment have been let, including four 30-ton and four 10-ton traveling cranes. This concern operates the following departments: bronze, and aluminum foundry, brass machine shop, tool room, grinding room casting shop, rolling mill, tinning.

After a corporate existence of thirty-four years, the business heretofore transacted by the **Nashua Saddlery Hardware Company** will be operated by the **Nashua Brass Company,** Nashua, N. H. The officers and stockholders of the Nashua Saddlery Hardware Company will be the officers and stockholders of the Nashua Brass Company, and the same trademark will be used. The new corporation acquires all the assets of the old, and assumes all its liabilities.

Glengarry Metal Wares, Ltd., has purchased the plant of the **Schell Foundry & Machine Company** at Alexandria, Ont., Canada, also the equipment of the plant of the **Leslie Tinware Company,** Ottawa, which will be removed to Alexandria and installed in the Schell foundry building. F. A. Leslie is vice-president and manager of the new company. This concern operates the following departments: tool room, cutting-up shop, galvanizing, japanning, stamping, tinning, soldering, polishing.

The **Root Company,** general office and works at Bristol, Conn., has with its increased sales policy, appointed John K. Light, as manager of its Detroit offices. Mr. Light, for years, has been associated with the Joseph N. Smith & Company, Detroit, Mich. The Root Company are large manufacturers of automatic counters, automobile and miscellaneous hinges, stampings, etc.—a large volume of their output being consumed in the automobile industry. Mr. Light will devote most of his energy to hinges for automobile hoods and windshields.

The **Hirsch Kupfer und Messingwerke** has combined with Hugo Stinnes for the practical employment of the metal casting process of the **Doehler Die Casting Company** of Brooklyn, N. Y., for the manufacture of aluminum and brass castings. Officials of the Doehler Die Casting Company stated that the Hirsch Kupfer und Messingwerke, German metal manufacturers, had bought the rights to manufacture die castings by the Doehler patents. The Doehler interests have sold a license to the Stinnes interests, who are permitted to sublet rights. The Doehler company is one of the world's largest producers of die castings which are used extensively in the automotive industry, and has sold similar patents in England, France, Switzerland and Italy.

The brass foundry of the **William Cramp & Sons Ship and Engine Building Company** has booked a number of orders recently of considerable importance in the marine field. The Cramp Company was lately awarded a contract by the Shipping Board for the manufacture of manganese bronze propeller blades aggregating about half a million pounds and constituting the requirements of the government merchant fleet for six months. An order has also been received from a private steamship company for a propeller wheel 15 feet in diameter and weighing about 15,000 pounds, to be cast of Cramp's high grade metal known as Parsons manganese bronze. The same shipowners also placed an order for four propeller blades to be cast of Cramp's superstrength bronze, which is a metal as strong as steel but non-corrodible, which steel is not. The tensile strength of these blades, which are for a wheel 18 feet in diameter, will be 110,000 pounds per square inch.

BUSINESS TROUBLES

Charging a conspiracy between a Cleveland manufacturer and a former superintendent, the Detroit Steel Products Company, filed suit in the Federal Court in Cleveland to restrain the McCann-Harrison Company, of Cleveland, and Joseph Gogan, former superintendent of the Detroit concern, from using plans for a spring forming machine, which, it is said, cost the Detroit company approximately $100,000 to develop. The bill of complaint names the McCann-Harrison Company and Joseph Gogan as joint defendants, the restraining of the manufacture of the spring forming machine by the Cleveland concern, and the return of alleged stolen designs being the principal objectives.

INCORPORATIONS

The **Bell Brass & Aluminum Company, Inc.,** has been incorporated to manufacture and cast metals, and started operations on February 1, 1924. The offices are at Paterson, N. J., and the works at Warren Point, N. J. G. A. Beil, president, was superintendent for McNab & Harlin Manufacturing Company of Paterson, N. J., for a number of years.

George M. Price Company, Inc., 2214 Catharine street, Philadelphia, Pa., has been incorporated with capital stock of $300,000 to manufacture castings of a special non-corrosive alloy, also valves, bathroom fixtures and general hardware products. This company will have the following departments: smelting, brass foundry, tool room, grinding room, casting shop, stamping, polishing.

Elmhurst Steel & Stamping Company, Elmhurst, Ill., has recently been incorporated with $100,000 capital stock, and has been in operation about a year. This firm manufactures a general line of metal stamping work, and also manufactures tools, dies and jigs. It is likewise equipped to do spot welding, japanning, enafneling, etc., and has a plant 40 x 150 ft., which is completely equipped. This concern operates the following departments: tool room, japanning, stamping.

The **Metal Tube Manufacturing Company,** 723 Fulton street, Chicago, Ill., has been incorporated to manufacture brass, copper and steel tubing, drawn products, tools and special machinery. C. M. Sperry is president. This concern will operate the following departments: brass machine shop, tool room, tinning, soldering.

Northern Bronze Corporation, Philadelphia, has been incorporated with $20,000 capital stock and will manufacture brass, bronze and aluminum castings. The company has a plant and office at 4212-20 Cresson street, Manayunk, Philadelphia, with 10,000 sq. ft. of floor space. Part of the work will be done by contract. This concern will operate the following departments: brass, bronze and aluminum foundry.

The **Pioneer Motor Bearing Company,** 800 Van Ness avenue, San Francisco, Calif., has been incorporated with $75,000 capital stock, acquiring a business established four years in manufacturing engine bearings, rods, crankshafts and brass shims for the automotive trade. Pure tin and sheet brass are used and the company is interested in surplus stocks of these commodities.

The **Special Machinery Company,** Bridgeport, Conn., recently organized with capital stock of $50,000, will manufacture machinery and metal goods. This firm will operate a tool room and stamping department.

Peckham Brass Foundry, Inc., 155 A street, Boston, Mass., was organized to take over the business of the late F. W. Peckham for the purpose of continuing the manufacture of high grade brass, phosphor bronze, composition and aluminum castings. The authorized capitalization is 1,000 shares no par value stock, all issued, book value $35,000; $15,000 preferred stock, not issued.

The United States Zinc Products Corporation has been incorporated and has taken general offices in Trenton, N. J. One of the departments of this new business is the operation of departments for the conversion of galvanizers by-products by a special patented process controlled by the Corporation, thus, it is claimed, enabling galvanizers to secure a greater remuneration for their by-products, which up to the present time have been hard to market. The plants for the conversion of these materials are to be located in various sections of the country and thereby eliminate excessive freight rates.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$500	$520
American Hardware Corporation	100	69	72
Anaconda Copper	50	33	33¼
Bristol Brass	25	12	14
International Nickel, com.	25	12½	13
International Nickel, pfd.	100	79½	81
International Silver, com.	100	80	..
International Silver, pfd.	100	106	110
National Enameling & Stamping	100	31	32
National Lead Company, com.	100	139	143
National Lead Company, pfd.	100	114	115
New Jersey Zinc	100	148	152
Rome Brass & Copper	100	120	135
Scovill Manufacturing Company, new	..	220	235
Yale & Towne Mfg. Company, new	..	68	70

Corrected by J. K. Rice, Jr., Co., 36 Wall Street, New York.

INDUSTRIAL CATALOGS

Quigley Acid-Proof Cement.—A booklet issued by the Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City, describing Quigley Acid-Proof Cement, a ready to use cement for bonding and surfacing acid-resisting masonry.

Century Crucibles.—A folder issued by Vesuvius Crucible Company, Swissvale, Pa., giving sizes and capacities of Century crucibles.

Grinder.—Bulletin No. 3016-S, issued by the Hisey-Wolf Machine Company, Cincinnati, Ohio, describing the Hisey Wide Swing Floor Stand Grinder.

Electrical Equipment.—Bulletins No. 210 and No. 400, issued by the Roller-Smith Company, 233 Broadway, New York City, illustrating and describing its ammeters, mille-ammeters, voltmeters, mill-voltmeters, volt-ammeters, galvanometers, shunts, multipliers.

Norton Floors.—A folder issued by Norton Company, Worcester, Mass., describing the company's various types of Alundum tiles, including Alundum Safety tile, Alundum Aggregate tile, Alundum Ceramic Mosaic tile.

Ganisand.—A booklet issued by the Quigley Furnace Specialties Company, Inc., New York City, illustrating and describing Ganisand which is used for refractory linings.

Sand Blast Machinery.—Bulletin No. 43, issued by the J. W. Paxson Company, Philadelphia, Pa., containing a complete description of sand blast machinery, sand blast rooms, sand blast barrels, and allied equipment, etc. This is a 48-page catalogue attractive in appearance and fully illustrated; a useful publication.

Review of the Wrought Metal Business

Written for The Metal Industry By J. J. WHITEHEAD, President, Whitehead Metal Products Company of New York, Inc.

The various fluctuations in ingot copper during the month of February developed a considerable amount of uncertainty in the market for fabricated brass and copper materials, with the result that both buyers and sellers of these materials passed through the month with varying and alternate feelings of hope and fear. About the middle of February the price of ingot copper stiffened up to such an extent as to bring about an advance of ½c per lb. in fabricated materials, and quite a volume of business was developed on that rise. Within a few days, however, the market again became weak and there was a period of price-cutting which has again culminated in a more or less demoralized market. At the end of the month

the price of ingot copper again headed upward and developed many questions as to whether the higher prices are likely to be permanent, and whether there will be still further rises, or, whether the market will again settle into dullness with another reaction.

No one seems to be able to predict just exactly what the future holds. However, as this is written at the end of the month announcements are made by various mining companies that a curtailment of production has been ordered and it is expected that this will make for higher prices in ingot copper. The various ups and downs of ingot copper during the month created a feeling of instability and some factors in the trade were making quotations on fabricated material which created a considerable amount of dissatisfaction and uncertainty.

This condition is especially acute in that branch of the industry which has to do with Sheet Copper. Competition for business in this line has been very acute with the result that prices have been forced down to a level which brings the spread between ingot copper and sheet copper prices to a point lower than has prevailed for many years. In fact, it has been stated that some of the prices made on certain grades of sheet copper are hardly high enough to cover the mill cost. Naturally, this condition cannot prevail for any extended time, especially, if there is any sustained rise in raw material.

A situation somewhat similar to that which has dominated the sheet copper trade has also prevailed among the manufacturers of brass rods and seamless tubes, although in these lines, the price cutting has not been quite so extensive. An enormous tonnage has been booked in the past few weeks by practically all of the brass and copper mills, and it is expected that with a higher market for ingot copper there will be a strong tendency toward a stabilized market.

In that branch of the non-ferrous trade which has to do with nickel and nickel alloys there has been great activity and business has gone forward on a scale greatly in excess of anything known since the war. In pure nickel grids for radio tubes there has been a huge tonnage placed, and in nickel resistence wires, generally, both for radio and other work, business has been very brisk and continues to improve. The electrical heating industry has contributed its quota to the general activity in this line and manufacturers of nickel chromium wire report that business in this commodity is in very satisfactory volume.

Many new developments have been going forward in Monel metal and nickel and the manufacturers of these two products report that their mill is operating full, and deliveries are from six to eight weeks behind the order book. Many of these developments have to do with the food packing industry. It has been found that Monel metal for use with table tops, meat hooks, meat moulds and similar articles lends itself easily to cleansing and sterilizing and imparts no metallic flavor to the food products. Canned soup and ketchup manufacturers have found that pure nickel provides complete immunity to corrosion and to the action of the natural acids in various meats and vegetables. As a result, there has been some large equipments contracted for in this line, in addition to those which are now actually in operation. Both Monel metal and nickel have been used by manufacturers of bakers' machinery, and recently some manufacturers have made Monel metal and nickel mixing bowls a standard part of their equipment. Various manufacturers of butter printing and cutting machinery have also adopted Monel metal as a standard part of their machines and all metal parts that come in contact with the butter are built of Monel metal.

Metal Market Review

Written for The Metal Industry by METAL MAN

COPPER

Sales of copper in February were large, but most of the business was done between 12½ and 13½ cents. The low prices were made early in the month, due to weak London cables and an increase in surplus stocks at American refineries.

A sudden and sharp advance occurred during the last week in February, in both the local and foreign markets, which lifted prices to 13¾ to 13⅞ cents.

Values had a further rise to 14 cents delivered to eastern domestic consumers, and good amounts of the metal was sold at that price. A further broadening out was also reported for export, with important demand from foreign buyers.

Calumet & Hecla, Anaconda, Inspiration, and Greene—Cananea mines are to reduce output of copper owing to prevailing low price of the metal. The first three companies passed regular quarterly dividends recently on account of necessity to husband cash resources. This voluntary reduction in output is expected to bring about a better statistical situation, and a more normal market.

ZINC

Market prices for zinc record a moderate gain compared with ruling values a month ago. The excess domestic production holds the market in check to the basis of 6.75 cents E. St. Louis and 7.10 cents New York. Surplus stocks are large, but export shipments act as a stay to market prices, although some good business was recently completed for domestic account. Zinc, like copper, has been in over-supply, and consumers count on this factor to justify prospects of full requirements at fair prices.

TIN

Record American deliveries and a remarkable rise in price were the features in tin. Demand continues insistent and expanding, and with the markets under the control of strong interests bullish movements have been bold and successful thus far. Price of Straits tin advanced from around 49 cents per pound on February 1 to 56½ cents on March 3.

The outstanding event in tin annals are the enormous domestic deliveries of 8,845 tons during February. This exceeds all previous records.

LEAD

The phenomenal strength of lead is largely due to the paucity of spot supplies in comparison with a persistent demand of large dimensions. Quotations in the outside market either New York or St. Louis deliveries are 9¾ to 10 cents, although the American Smelting Co. quotes 9 cents to special customers. Consumption is heavy and expected to continue on a large scale. Sellers are consequently able to dictate prices, and they are taking opportunity to reap the unusual advantages of the present tense situation. There is an absence of any semblance of selling pressure at present, and buyers have no option but to pay current prices when placing orders. Supplies at foreign sources are also small and have undergone a radical reduction in recent months.

ALUMINUM

Underlying conditions in this market have been favorable to market firmness since the first of the year. Recent sales were in large volume for shipment over the balance of the year for imported aluminum at 28 cents for 99 per cent plus grade and 27 cents for 98-99 per cent grade. There were rumors that the domestic maker was shading these prices, but this cannot be confirmed as terms of trade on the home product are not for publication. Resale lots are rather scarce, and remelted material finds ready sale. The automotive industry is using large quantities of aluminum. Production of aluminum in the United States in 1923 is estimated at fully 90,000 tons, against estimated output for 1922 of 52,000 tons. The heaviest production ever reported was in 1918 with an estimated output of 102,000 tons. European capacity is estimated at around 70,000 tons last year, compared with 65,130 tons in 1922.

ANTIMONY

The market for antimony is stronger and prices firm at 11¼

to 11½ cents for spot delivery of Chinese duly paid. Firm offers from the Orient are scarce, with March-April shipment from China quoting 9 to 9¼ cents, c. i. f. New York. Trading is quiet and buyers conservative at present quotations. A scarcity of available metal at shipping points is reported.

QUICKSILVER

Buying is on small scale and price quoted is $60 for 75-pound flasks. Local supplies are said to be large and the tone of market is consequently easy. Recent London quotation was £9 12s 6d to £9 15s. Several weeks ago some of the large buyers covered requirements for six months.

PLATINUM

Improved demand and firmer conditions have resulted in an advance for refined platinum to $125 an ounce. Spot stocks have been reduced and the outlook is brighter.

SILVER

A fairly good demand for silver lately has maintained bullion prices around 64 cents an ounce. Early in February sales were made up to 65 cents against as low as 62½ cents during latter part of January. The highest price last year was 68⅞ cents on April 30. China and India were buyers in February, with London taking important shipments. Imports of silver into this country in January were $5,927,745, compared with $8,172,301 in December previously. Exports in January amounted to $8,120,648, against $9,521,083 in December. Mexican operations are expected to be resumed on a larger scale soon.

OLD METALS

Dealers are having an active demand for lead. High prices for new metal has stimulated buying of scrap lead. Heavy lead has brought 7¼ to 7½ cents and there is possibility that even better than this would be paid. Battery plates and electrotype scrap are also in good demand. Old copper and brass alloys were rather weak lately, but with new copper in stronger demand at higher prices a revival in buying of the red metals is looked forward to. Prices dealers are ready to pay quote as follows: Crucible copper, 10¼ to 10½ cents; light copper, 9 to 9¼ cents; low brass clippings, 8¼ to 8½ cents; heavy brass, 6½ to 7 cents; heavy lead, 7½ to 7¾ cents; aluminum clippings, 19½ to 20 cents; battery lead, 4¾ to 5 cents, and zinc scrap, 4 to 4¼ cents.

WATERBURY AVERAGE

Lake Copper—Average for 1923, 14.979—January, 1924, 13.00—February, 13.125.

Brass Mill Zinc—Average for 1923, 7.479—January, 1924, 7.25—February, 7.50.

Daily Metal Prices for the Month of February, 1924

Record of Daily, Highest, Lowest and Average

	1	4	5	6	7	8	11	12*	13	14	15	18
Copper (f. o. b. Ref.) c/lb. Duty Free												
Lake (Delivered)	13.00	12.75	12.75	12.75	12.75	12.75	13.00	.....	13.00	13.25	13.375	13.625
Electrolytic	12.55	12.50	12.50	12.50	12.50	12.50	12.65	.....	12.75	12.95	13.05	13.375
Casting	12.40	12.375	12.375	12.375	12.375	12.375	12.50	.....	12.60	12.75	12.90	13.25
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	6.55	6.60	6.65	6.65	6.65	6.70	6.70	.....	6.75	6.80	6.90	6.95
Brass Special	6.65	6.70	6.75	6.75	6.75	6.80	6.80	.....	6.80	6.85	6.95	7.00
Tin (f. o. b., N. Y.) c/lb. Duty Free												
Straits	49.375	49.75	51.00	52.00	53.00	53.00	51.75	.....	54.00	54.50	55.00	54.875
Pig 99%	48.875	49.25	50.50	51.50	52.00	52.00	51.25	.....	53.50	54.00	54.50	54.375
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	8.40	8.40	8.50	8.50	8.60	8.75	8.90	.....	9.00	9.10	9.30	9.50
Aluminum c/lb. Duty 5c/lb.	28.50	28.50	28.50	28.50	28.50	28.50	28.50	.....	28.50	28.50	28.50	28.50
Nickel c/lb. Duty 3c/lb.												
Ingot—Internat. Nick. Co.	29	29	29	29	29	29	29	.....	29	29	29	29
Outside Spot	28	28	28	28	28	28	28	.....	28	28	28	28
Electrolytic (Internat. Nick. Co.)												
Ni.—99.80 contam. impur.—.14	32	32	32	32	32	32	32	.....	32	32	32	32
Brit.-Amer. Nick. Corp.												
Ni.—98.50 contam. impur.—.80	28	28	28	28	28	28	28	.....	28	28	28	28
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	10.50	10.50	10.50	10.50	10.50	10.50	10.50	.....	10.50	10.75	11.00	11.00
Silver (foreign) c/oz. Troy. Duty Free	63.875	64.25	64.00	64.00	64.125	64.125	64.875	.....	65.25	65.25	65.00	64.625
Platinum $/oz. Troy. Duty Free	122	125	125	125	125	125	125	.....	125	125	125	125

	19	20	21	22*	25	26	27	28	29	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free												
Lake (Delivered)	13.50	13.50	13.50	.....	13.375	13.375	13.375	13.375	13.625	13.625	12.75	13.191
Electrolytic	13.25	13.25	13.125	.....	13.00	12.90	13.00	13.125	13.40	13.40	12.50	12.888
Casting	13.125	13.125	13.00	.....	12.875	12.75	12.875	12.875	13.125	13.25	12.375	12.738
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	6.90	6.85	6.85	.....	6.85	6.85	6.80	6.80	6.80	6.90	6.55	6.768
Brass Special	7.00	6.95	6.95	.....	6.95	6.95	6.85	6.85	6.85	7.00	6.65	6.850
Tin (f. o. b., N. Y.) c/lb. Duty Free												
Straits	53.75	54.25	54.25	.....	54.125	55.00	54.75	55.00	55.75	55.75	49.375	53.428
Pig 99%	53.25	53.75	53.75	.....	53.625	54.50	54.25	54.50	55.25	55.25	48.875	52.875
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	9.00	9.25	9.50	.....	9.50	9.50	9.50	9.75	10.00	10.00	8.40	9.103
Aluminum c/lb. Duty 5c/lb.	28.50	28.50	28.50	.....	28.50	28.50	28.50	28.50	28.00	28.50	28.00	28.474
Nickel c/lb. Duty 3c/lb.												
Ingot—Internat. Nick. Co.	29	29	29	.....	29	29	29	29	29	29	29	29
Outside Spot	28	28	28	.....	28	28	28	28	28	28	28	28
Electrolytic (Internat. Nick. Co.)												
Ni.—99.80 contam. impur.—.14	32	32	32	.....	32	32	32	32	32	32	32	32
Brit.-Amer. Nick. Corp.												
Ni.—98.50 contam. impur.—.80	28	28	28	.....	28	28	28	28	28	28	28	28
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	11.00	11.00	11.00	.....	11.00	11.00	11.00	11.00	11.25	11.25	10.50	10.795
Silver (foreign) c/oz. Troy. Duty Free	64.25	64.00	64.25	.....	64.125	64.25	64.00	63.75	64.125	65.250	63.75	64.322
Platinum $/oz. Troy. Duty Free	125	125	125	.....	125	125	125	125	125	125	125	125

*Holiday.

Metal Prices for March 10

Copper: Lake, 14.25. Electrolytic, 14.00. Casting, 13.625.
Zinc: Prime Western, 6.65. Brass Special, 6.75.
Tin: Straits, 56.75. Pig, 99%, 56.25.
Lead: 9.70. **Aluminum,** 28.00.
Nickel: Ingot, Internat. Nickel Co., 29. Outside spot, 28. Electrolytic, Internat. Nick. Co., 32. Brit. Am. Nick. Corp., 28.
Antimony, 11.50. **Silver,** 64.00. **Platinum,** 125.

Metal Prices, March 10, 1924

INGOT METALS AND ALLOYS

Brass Ingot, Yellow	9½to11
Brass Ingots, Red	12¼to15
Bronze Ingot	13 to14
Bismuth	$2.40
Cadmium	75
Casting Aluminum Alloys	21 to24
Cobalt—97% pure	$2.75
Manganese Bronze Castings	22 to35
Manganese Bronze Ingots	13 to16
Manganese Bronze Forging	33 to42
Manganese Copper, 30%	28 to45
Parsons Manganese Bronze Ingots	17½to19
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18 to21
Phosphor Copper, guaranteed 10%	17½to21
Phosphor Tin, guaranteed 5%	58 to68
Phosphor Tin, no guarantee	53 to63
Quicksilver, per flask, 75 lbs	$61—62
Silicon Copper, 10%...according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
11¾to12	Heavy Cut Copper	13¼to13¾
11¼to11½	Copper Wire	12¾to13
9¾to10	Light Copper	11 to11½
9¾to10	Heavy Machine Comp.	11¼to11¾
7 to 7¼	Heavy Brass	9¼to 9¾
5¾to 6¼	Light Brass	7 to 7½
7¼to 7½	No. 1 Yellow Brass Turnings	8 to 9
9 to 9¼	No. 1 Comp Turnings	9¾to10½
5¾to 6¼	Heavy Lead	6¼to 6½
2¾to 3½	Zinc Scrap	3¾to 4¼
8¼to 8¾	Scrap Aluminum Turnings	10¾to11¼
14¼to14¾	Scrap Aluminum, cast alloyed	16¼to16¾
15¼to16¼	Scrap Aluminum, sheet (new)	17¼to18¼
22¼	No. 1 Pewter	26¼
13¼	Old Nickel anodes	15¼
21¼to23¼	Old Nickel	25¼to27¾

BRASS MATERIAL—MILL SHIPMENTS

In effect Mar. 3, 1924

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.18¼	$0.20	$0.22
Wire	0.18¾	0.20½	0.22½
Rod	0.16	0.20¾	0.22¾
Brazed tubing	0.26¼	.....	0.31¾
Open seam tubing	0.26¼	.....	0.31¾
Angles and channels	0.29¼	.....	0.34¾

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19¼	$0.21	$0.23
Wire	0.19¾	0.21½	0.23½
Rod	0.17	0.21¾	0.23¾
Brazed tubing	0.27¼	.....	0.32¾
Open seam tubing	0.27¼	.....	0.32¾
Angles and channels	0.30¼	.....	0.35¾

SEAMLESS TUBING

Brass, 22½c. to 23½c. net base.
Copper, 23¾c. to 24¾c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	20¼c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18¼c. net base
Muntz or Yellow Rectangular Sheets other Sheathing	19¼c. net base
Muntz or Yellow Metal Rod	16¼c. net base

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21¼c. to 22¾c. net base
From stock	21¾c. to 23¾c. net base

BARE COPPER WIRE—CARLOAD LOTS

16½c. to 16⅝c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	20½c. net base
100 lbs. to 200 lbs. in one order	21c. net base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 9¾c. basis less 8 per cent. discount.

Casks, jobbers' prices	11¼c. net base
Open casks, jobbers' prices	11¾c. to 12¼c. net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	37c.
Aluminum coils, 24 ga. and heavier, base price	35c.
Foreign	38-40c.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Nickel Silver Sheet Metal

10%	Quality	25½c.
15%	"	26¾c.
18%	"	27¾c.

Nickel Silver Wire and Rod

10%	"	28¾c.
15%	"	32c.
18%	"	35c.

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	48
Hot Rolled Sheets (base)	42

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheets—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Above prices f. o. b. mill.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 67¼c. to 69¼c. per Troy ounce, depending upon quantity.

Rolled sterling silver 64¾c. to 66¾c.

NICKEL ANODES

85 to 87% purity	37½c.-39½c.	per lb.
90 to 92% purity	40c.-42c.	per lb.
95 to 97% purity	42c.-44c.	per lb.

Supply Prices, March 10, 1924

CHEMICALS

In Commercial Quantities—New York Prices

Acetone	lb.	.18–.19
Acid—		
Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg. Carboys	lb.	.06
Nitric, 42 deg. Carboys	lb.	.07
Sulphuric, 66 deg. Carboys	lb.	.02
Alcohol—		
Butyl	lb.	.45–.50
Denatured in bbls.	gal.	.51–.55
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.04½
Aluminum sulphate, commercial tech	lb.	.02½–.03
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—		
Sulphate, tech, Barrels	lb.	.03¾
Sulphocyanide	lb.	.65
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.16
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.06
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.07
Chrome Green, bbls.	lb.	.36
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.37
Carbonate, Barrels	lb.	.20
Cyanide	lb.	.46
Sulphate, Barrels	lb.	.05½
Copperas (Iron Sulphate, bbl.)	lb.	.02
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	6.75
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.26
Shellac	lb.	.59–.61
Iron, Sulphate, see Copperas, bbl	lb.	.02
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	1.15
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.22¼
Salts, single bbls	lb.	.10½
Salts, double, bbl	lb.	.10
Paraffin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic Electrolytic 88-92% fused, drums	lb.	.09
Potassium Bichromate, casks	lb.	.09¾
Carbonate,80-85%, casks	lb.	.06
Cyanide, 165 lb. cases, 94-96%	lb.	.65
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls	lb.	.03
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.45¾
Soda Ash, 58%, bbls	lb.	.02½
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.06
Cyanide, 96 to 98%, 100 lbs	lb.	.22
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.03
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass) bbls	lb	.02
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.13
Sulphur (Brimstone) bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.39
Tripoli, Powdered	lb.	.03
Verdigris, see Copper Acetate	lb.	.37
Water Glass, see Sodium Silicate, bbls	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.35
Whiting, Bolted	lb.	.02½–.06
Zinc, Carbonate, bbls	lb.	.13–.17
Chloride, 600 lb. lots	lb.	.07
Cyanide	lb	.37
Sulphate, bbls.	lb.	.03¼

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	42.25
14 inch, 20 ply, 64/68, cloth	base,	52.55
12 inch, 20 ply, 84/92, cloth	base,	46.20
14 inch, 20 ply, 84/92, cloth	base,	62.25
12 inch, 20 ply, 88/96, cloth	base,	51.05
14 inch, 20 ply, 88/96, cloth	base,	68.80
Sewed Buffs, per lb., bleached and unbleached	base,	.65 to .76

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"	2.75	2.50
" 6" 8" and over 16"	1" to 3"	2.85	2.60
" 6" to 24"	Over 3"	3.15	2.80
" 6" to 24"	⅛" to 1"	3.75	3.50
" 4" to 6"	¼" to 3"	4.75 }	Any quantity
" Under 4"	¼" to 3"	5.35 }	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes, 50c. advance.